

FLOOD MANAGEMENT IN NEW ZEALAND: EXPLORING MANAGEMENT AND PRACTICE IN OTAGO AND THE MANAWATU

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ABSTRACT

This research assesses how effective present flood management is in New Zealand, and what it may come to look like in the future. The importance of effective flood management is amplified by both human development in floodplains and the consequences of climate change on the hydrological system. Analysis of the practices in the Manawatu and Otago regions was undertaken to meet the aims of this research.

Five objectives were developed to structure this research. These objectives were to: examine the literature surrounding this topic to establish a theoretical basis from which to build the study; investigate the extent of difference residents of rural and urban settings understand and react to flooding; evaluate current flood policy within the specified regions, and what factors influence current and future policy; evaluate the role of risk-based management in current policy and the influence it has on the shape of future policy; and examine the role of climate change in influencing current and future approaches to flooding in New Zealand.

The literature review established a number of concerns and issues which affect modern flood management. The literature review made clear the need to approach flood management as part of a wider system of environmental management, while recognising that both the past and future have a significant influence on management practices. An analysis of current planning documents was conducted to assess current policy, using five components: mitigation; adaptation; avoidance; social capacity building; climate change. These components allowed for comparison of management practices between the two regions.

Several key conclusions were found following this analysis, these include a recognition that flood management is most effective when regions can determine their approach, rather than allowing greater control from central government. Additionally, other environmental issues occurring in and around river and lake beds complicate the response to flooding. While current flood defence measures are acceptable in both regions, there is significant room for improvement in some of the assessed components. Finally, historical settlement of flood-prone areas and decisions made by past leadership continue to influence both the current situation and must be accounted for in future planning decisions.

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COMMONLY USED ACRONYMS

Otago Regional Council - ORC

Dunedin City Council - DCC

Horizons Regional Council - HRC

Manawatu District Council - MDC

Local Government Act 2002 - LGA

Resource Management Act 1991 - RMA

Ministry for the Environment - MfE

Sea level rise - SLR

1 INTRODUCTION

1.1 INTRODUCTION

Flooding is an issue that occurs worldwide in areas close to water sources. Flood events can prove devastating to both people and communities. The flooding that occurred in Auckland in March of 2017 serves as a recent example of the consequences of flooding and the damage it can cause (New Zealand Herald, 2017).

Hazard management has undergone significant change over the last eighty years internationally, shifting from an adversarial stance towards a more accepting and adaptive approach towards flooding. Of these hazards, flooding is considered the “most frequent and costly natural disaster” (Bryant, 2005) in New Zealand. This thesis seeks to explore local government policy related to flooding and how risk-based methods might enhance policy, in both urban and rural environments. The thesis analyses two different regions, Otago and Manawatu-Whanganui, with four councils, Otago Regional Council (ORC), Dunedin City Council (DCC), Horizons Regional Council (HRC), and Manawatu District Council (MDC). Both locations having experienced flooding during a similar period (2015) allows for a more accurate comparison between the two due to the similar length of time since the flood events.

The research presents an opportunity to investigate two different regions and their response to flooding. This analysis takes on additional importance when the potential changes derived from climate change are considered, especially regarding the causes and severity of flood events. Both regions are notable for having a high degree of human settlement on floodplains within them and have experienced severe flooding within the last fifteen years this allows for a balanced comparison between local authorities.

Rural and urban activities place different demands upon the land. Additionally, they require different responses and management when flood events occur. More generally, due to differences in population density, the human and economic impact of flooding can differ considerably. The dominance of the agricultural sector within the New Zealand economy adds further complications, as the effects of flooding on productive land can have consequences long after the flood event itself.

The two regions present an opportunity to assess river flooding in two differing settings, allowing for comparisons and contrasts to be drawn from the different management strategies employed by local government now and in the future.

1.2 FLOODING IN NEW ZEALAND

Considered to be the most dangerous natural hazard to society, both in both social and economic factors, flooding is a major issue worldwide and in New Zealand (Keller and DeVecchio, 2016; Schanze, 2006b). The two selected regions, Manawatu-Whanganui and Otago, have both suffered significant flooding since the turn of the millennium, Manawatu in 2004 (Stowell, 2016), 2015 (New Zealand Herald, 2015), and Dunedin in 2015 (Otago Daily Times, 2015).

While geological hazards have captured the popular imagination, floods are a major issue in New Zealand. New Zealand has experienced several severe metrological hazards in its history. Changes to the landscape have also negatively affected the landscape, as changes to riverside vegetation have undermined natural protections (Glavovic et al., 2010). Climate change further complicates flood management, and in the future is projected to increase both the intensity and frequency of flooding, especially in floodplains and coastal areas, areas which include the two chosen study sites (Bell et al., 2002).

Flooding threatens people and places in several ways. The most immediate are the potential for loss of life that floods have, with around 100,000 deaths globally directly related to flooding in the closing decade of the twenty-first-century (Jonkman, 2005). Several flood events have led to a loss of life in New Zealand. A blizzard and flood event in the Central Otago goldfields led to the death of over 51 people in 1863, and a subsequent flood event in 1878 in Central Otago caused significant property damage and two deaths (McLintock, 1966a; McIntock, 1966b). In the previous century, the International Disaster Database identifies 32 deaths which were a result of flood events in New Zealand (Centre for Research on the Epidemiology of Disasters, 2016).

Floods are notable for the long-term economic damage they can cause, particularly in rural areas where vegetation growth is adversely affected by flooding (Shanklin and Kozlowski, 1985). Additionally, floods can have a negative impact in rural areas due to loss of stock, roads, housing, clean-up costs and disruption they bring to livelihoods (Merz et al., 2010). Flooding in rural communities can put a strain on the ability of areas to provide adequate food and has

consequences for soil erosion and quality. Soil erosion is a concern internationally, significant in both the United Kingdom (Tunstall et al., 2004), and in New Zealand (Wilkinson, 1999).

In addition to these immediate impacts, there are more indirect effects. Frequent flooding is likely to result in the decreased development of the affected region, due to constant infrastructure damage (Tunstall et al., 2004). In urban conditions floods, again, negatively impact housing, infrastructure, business, and the ability of people to go about their daily lives. Damage to cities and other major economic areas also indirectly harm the area around them, limiting the ability to sell and move goods through ports and other transit points, as well as rendering suppliers unable to sell stock onwards (Merz et al., 2010). Due to greater population densities, urban flooding often exceeds the economic effects of rural flooding, which can exacerbate long-term issues such as rebuilding and regional recovery (Merz et al., 2010). Preparation for these events, as well as the mechanisms for recovery significantly affect the costs in the recovery phase (Smith, 1981).

Beyond the economic and physical factors, research has identified that flooding comes with a noticeable psychological component (Tunstall et al., 2004). This psychological aspect has received less focus than the physical impacts of flooding but can continue to be felt, long after the physical impacts have faded (Messner and Meyer, 2006; Tunstall et al., 2004).

The nature of floods as hydrological events, complicates the response to flooding as conditions are often unique to particular watersheds and systems (Tunstall et al., 2004). Consequently, a comprehensive risk management system is complex and challenging to develop on the national scale, and arguably on the regional scale too. Historically in the United Kingdom, flood protection was managed by boards responsible for singular catchments, an example of management on the micro-scale (Tunstall et al., 2004). Within New Zealand, management of natural hazards falls upon Regional Councils who are expected to develop management plans for both protecting and dealing with hazard events, including flooding. This localised approach allows for more specific management practices to be employed, without the possibility of losing cohesion across the region.

The above is compounded with the current shift away from the tendency for people and governments to place their trust in large engineering works and shifting towards more cost-effective methods, illustrated by the proposed flood plan for Northern Massachusetts (Hayes, 2004). The United Kingdom also serves as an example of a country embracing risk-based

management (Tunstall et al., 2004), alongside New Zealand (Saunders and Kilvington, 2016; Kilvington and Saunders, 2015). These examples indicate a movement away from ‘hard’ solutions of hazard management and towards ‘softer’ methods.

1.3 METHODOLOGICAL APPROACH

Saunders et al. (2015) provided an exclusive study of hazard management plans and evaluated all Local Government Authorities in New Zealand. There is room for a more focused study, directed at flooding, and the differences, if any, within plans concerning urban and rural flooding as well as current and future approaches.

A predominantly qualitative approach has been used to approach this research, with the methodology discussed in further detail in Chapter Three. Within the hazard management and local government frameworks a number of relevant organisations and interested parties are identified from whom to seek information. These individuals and groups represent a diverse range of opinions, views and interests in both the planning framework and management of hazards.

The research also has broader relevance outside of the study areas. While the research concentrates on two specific regions of New Zealand, its focus on a possible rural/urban divide gives it relevance within all New Zealand regions and offers potential international applications too.

1.4 RESEARCH AIM

The research aim is to evaluate how the Regional and District Councils of the Manawatu and Dunedin City address rural and urban flooding in policy and investigate current and future direction of this policy, with an additional goal of investigating the degree of influence that climate change has on policy.

1.5 RESEARCH OBJECTIVES

The key objectives of this research are:

- To examine the literature surrounding this topic to establish a theoretical basis from which to build this study.

- To investigate the extent to which there is a difference in how residents of rural and urban settings understand and react to flooding.
- To evaluate current flood policy within the specified regions, and what factors influence current and future policy.
- To evaluate the role of risk-based management in current policy and the influence it has on the shape of future policy.
- To examine the role of climate change in influencing current approaches to flooding in New Zealand and the role that it has in shaping future approaches.

1.6 CHAPTER OUTLINE

This chapter has identified the study areas, provided a broad overview of the relevance of the subject matter and the specific aims and objectives of the research. Additionally, there has been a discussion of the framework forming the base of the research.

Chapter Two explores the theory to construct a theoretical base for the research. Additionally, the chapter explores the theory surrounding research objectives ii to v.

Chapter Three discusses the methodological approach utilised by this study to examine current flood policy. This chapter outlines the approach adopted for the case studies and the specific techniques used to inform the research.

Chapter Four provides an analysis of planning documents that are used to frame and guide flood policy in the study areas. The chapter also discusses and develops a method with which to evaluate and compare the plans against one another.

Chapter Five evaluates the major themes and concepts raised by Key Informants in a series of semi-structured interviews relating to flood policy. These play a role in shaping both policy and the effectiveness and success of these policies. It also explores the role that relationships between various authorities, both local and national have on flood management and its success.

Chapter Six discusses the information revealed by the study and its relation to the literature discussed in chapter two, drawing on both the literature and the findings of this research to explore the challenges associated with flood management in New Zealand.

Chapter Seven concludes the research by summarising the findings, suggesting avenues for future research and providing a final remark and reflection on the research.

2 FLOOD MANAGEMENT AND FUTURE IMPACTS

2.1 INTRODUCTION

As a foundation, the literature review is critical to the development of research (Hart, 1998). This chapter is divided into four sections, each based on one of the identified research objectives, reviewing publications in regard to, flood event impacts (economic, environmental and social) in rural and urban settings, flood hazard policy, risk-based assessment methods and the potential impact Climate Change will have on future flood events. These sections are further divided into subsections specifically focused on aspects of the broader subject. The chapter concludes by summarising the findings made, and what a potential future may be as suggested by the literature.

Godschalk (2003) observed that there had been a large body of research concerned with how natural hazards occur, and how people living in affected areas must manage the aftermath of the event (Godschalk, 2003). This literature review intends to investigate the current knowledge on flood impacts and hazard policy concerning these events and their effects.

Flooding is best understood as a situation where there is a rising and overflowing of a body of water, especially onto dry land (Whitfield, 2012). This water can come from both coastal and meteorological events. Flooding can occur anywhere where there is a body of water with the potential to overflow. Flooding can have both negative and positive effects, for example, flood events can lead to increased soil fertility as seen in the case of the regular flooding of the Nile in Ancient Egypt. There can be significant adverse effects, such as the 2004 Manawatu Floods in New Zealand which saw widespread damage to parts of the region (Fuller and Heerdegen, 2005).

When classifying flood effects, divisions are made between direct and indirect. This is further broken down into tangible and intangible effects which differentiate through determining if the effects can be assigned a monetary value. Section 2.3 uses these classifications to divide and assess the different effects that exist, in both urban and rural areas (Parker et al., 1987; Smith and Ward, 1998).

The consequences of flooding are significant regardless of whether they occur in urban or rural environments. To this end, communities and individuals have historically, attempted to

eliminate some of the risks from flooding. During the settlement of what would become Wellington, the initial site, in what is now the Hutt Valley, was abandoned due to flooding of the Hutt River. Alternatively, large engineering projects have dominated historically, with the Dutch Netherlands offering one major example with their dyke system, which aims to prevent flooding of the low lying (below sea level) countryside.

The future is uncertain. Climate change brings the potential for significant changes in weather with the potential to change not only the intensity of flooding, which has seen a general increase since the turn of the century, but also the frequency too. With many one in one hundred year and one in two hundred and fifty-year floods occurring with greater regularity than expected. These events, in turn, mean that policy, in both rural and urban settings, will face challenges in the future, particularly from uncertainty arising over whether current protection works will be able to withstand greater discharges and an increasing number of at-risk areas.

Alongside these changes, there has been a shift in the management of flood hazards. Combined with changes in the scale and range of flood events, new approaches are coming to dominate. heralding a movement away from the use of engineering to limit damage and instead shifting focus to more adaptive and preventive measures, including building regulations such as floor levels and zoning titles.

This means that past approaches are unlikely to be applicable in the future. There is also need to recognise that rural flooding differs significantly from urban flooding, in their effects, contributing factors and the way in which they are managed. Section 2.4 further explores these issues in more detail.

2.2 RURAL AND URBAN FLOODING

While there are similarities between urban and rural flooding, there are also fundamental differences. Flooding becomes a hazard when it affects a community, and this could be either a town, city or simply a farm, provided the community be vulnerable to that hazard (Burton, 1993). The damage caused by a hazard is dependent on what is exposed. In the case of flooding, the damage is limited to what is at risk of flood damage (Schanze, 2006a). Figure 2.1 below shows the interplay between the human world and the natural world, concerning hazardous events, illustrating this relationship.

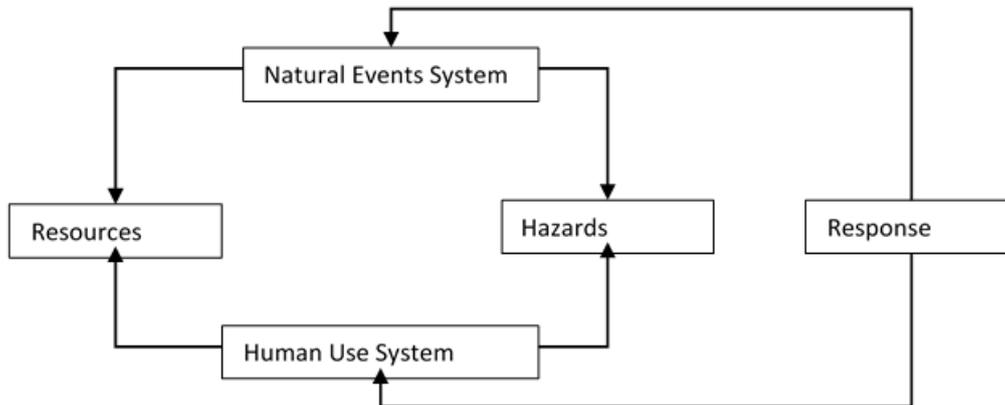


Figure 1: Resources and Hazards from nature and man, adapted from Burton (1993)

Initially, there was a belief that natural disasters were an entirely natural occurrence. The research was focused on the physical conditions and attempted to anticipate strength, location and frequency (Kitchin and Thrift, 2009). Attempts to reduce the impact of the hazard focused on engineering and new technologies, which combined with countries (such as the UK) seeking to maximise arable land, saw significant development of the countryside (Mileti and Gailus, 2005; Tunstall et al., 2004). Despite these high levels of investment, losses through flooding have continued to rise in the period following the Second World War (Montz and Gruntfest, 1986).

2.2.1 URBAN FLOODING EFFECTS

It has been observed in the United States that as floodplains are urbanised, there are greater benefits to be gained from flood control measures due to the exposure of more people (Smith, 2013). Cost-benefit analysis in these conditions has leaned heavily in favour of construction, which fuels further development due to perceptions of adequate protection on the floodplain. The endpoint of this is increased development in at-risk areas due to a perceived sense of security, adding to the potential damage should flooding occur (White, 1958). This fuels demand for further protection works (Montz and Gruntfest, 1986). Despite the expense and potential for adverse environmental impacts (Parker, 1995).

Urbanisation results in higher levels of runoff water, through a loss in permeability owing to the use of concrete and other sealants reducing ground intake of water (Graff, 1976). Urbanisation often causes water beds to elevate in the absence of regular dredging. This elevation of riverbeds, in turn, reduces the protective measures over time and adds to ongoing maintenance costs (Paul and Meyer, 2001).

Significant development has subsequently occurred on floodplains, although the exact percentage of this is unclear (Montz and Gruntfest, 1986). In the United States, this changed when legislation shifted away from federal spending on protection and the adoption of local land use regulations (Montz and Gruntfest, 1986). Significant research investigated the impact that these changes had, both regarding their effectiveness (Hutton and Mileti, 1979), (Burby and French, 1981) and the economic impact of these regulations, particularly on house prices (Damianos and Shabman, 1976; Muckleston, 1983), (Montz, 1981). Kusler (1980) also makes the point that despite the changes, many parts of the United States were continuing to fund structural flood control methods, significantly increasing the costs. Flood control continued to see high use throughout the twentieth century (Kusler, 1980; Messner and Meyer, 2006).

While it might be assumed population growth would, in turn, lead to a greater number of people living on the floodplain, this does not appear to be correct. White (1958), noted that "...a substantial invasion of flood-prone areas, even in cities with stable or declining population numbers" suggesting population growth was not linked to settlement of flood plains (White, 1958, pg 203). This lack of a relationship was also present in the period from 1958 to 1986 (Montz and Gruntfest, 1986). However, the data indicates that in the years following 1958, the "Substantial invasions" that White identified are no longer occurring, there is still increasing numbers of people using the floodplains and placing themselves at risk. A later study, (1988), of a further ten American cities, indicated that floodplain management initiatives had been successful in diverting development away from the flood plains (Burby and French, 1981). The development of infrastructure, such as highways in flood-prone areas is also of interest, and literature which explores this reflects other observations similar to those made by White (Parola and Parola, 1998).

Since the turn of the century, the discussion in the United States has focused on the flood insurance system, and the associated problems with it. In particular, Burby et al. (2001) identified a failure to identify at-risk areas accurately and to reduce or limit the growth of cities in flood plains.

In the United Kingdom, there was the belief that the Town and Country Planning Act (1947) had slowed expansion into urban floodplains (Parker and Penning-Rowell, 1983). Although the lack of a systematic study, such as what White and Montz produced for the United States, means that there is insufficient data to test this theory (Harding and Parker, 1974; Penning-Rowell and Parker, 1974). In a later study, Parker linked development in floodplains to other issues that

exposed those living in these areas to significant risk, including increasing the exposure of more businesses to greater risk. Increasing car ownership fuels demand for new roads in at-risk areas, elevating congestion risk and exposing more people to danger during flood events if they attempt to evacuate along these routes. Furthermore, this places those in positions of authority under additional stress over time as mechanisms must be developed to manage these new risks (Parker, 1995).

Parker also discusses the “escalator effect” whereby protective works are built to reduce flood impact, which fuels further development which requires greater protective works, at which point the cycle repeats itself (Parker, 1995). Non-structural approaches would then make sense as a way to break out of this cycle. Parker's arguments have some resemblance to White’s observations in the 1950s.

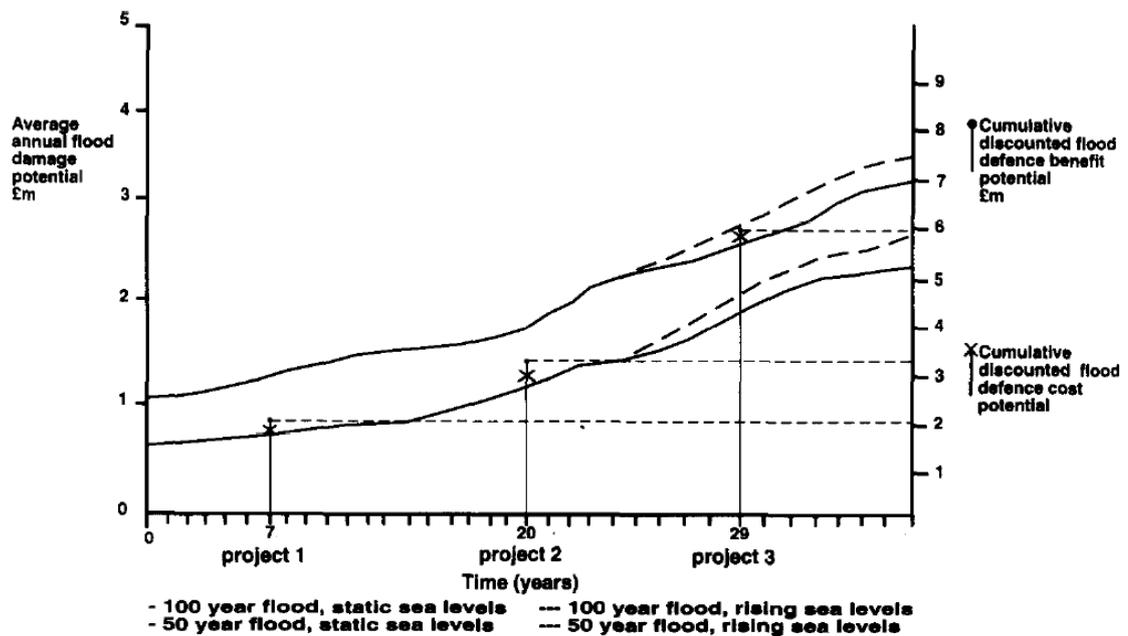


Figure 2: The flood defence 'escalator effect' taken from Parker (1995)

Similarly to the United States, within the United Kingdom, over the previous century there has been a general increase in the scale of urban development based within floodplains. This development occurred despite the planning system used by the United Kingdom, which rather than halting, only slowed floodplain development (Parker, 1995). Parker also makes the point that development of the floodplain has benefits regarding preserving green belts and preventing settlement coalescence (Parker, 1995).

Part of the issue that lies with urban flooding is the argument over the degree to which an individual’s liberty and their ability to choose where and how they live compares to the role of the state in preventing citizens from coming to harm (Pottier et al., 2005). Within the Urban

setting then, the core issue with flooding is managing land in such a way that people are not put at unnecessary risk, while still utilising effective land management practices.

2.2.2 RURAL FLOODING EFFECTS

While urban flooding is perceived to have a greater effect due to higher population, rural flooding is significant for the long-term consequences it can have and the negative impact on rural economies. Rural Flooding is of particular concern for New Zealand due to the significance of the rural sector to the national economy. There is also the potential for adverse environmental impacts, especially in regard to river systems, which makes rural flooding a concern for New Zealand.

Following the Second World War it was an aim of the government of several countries including the United Kingdom, to achieve food independence (Tunstall et al., 2004), an attitude mirrored in mainland Europe (Rouquette et al., 2011). This desire resulted in rural regions enjoying an increased level of flood protection in the post-war period. It has also meant that there are very few river systems that have not seen some level of modification (Hale and Adams, 2007). In recent years, this high level of support has declined, as a result of shifting government priorities from flood defence and towards a more integrated model of management, based on both probability and consequence based decision-making (Tunstall et al., 2004). However, the broad range of opportunities that they offer has also meant that the land and water resources face conflicting demands (Morris et al., 2009).

While urban settlements limit the permeability of the ground through sealing and housing, this also occurs in rural areas. Land clearance has had a negative impact on the permeability of cleared areas (Hewlett and Doss, 1984), while vegetation is dependent on the depth of the water table, influenced by the quality of drainage within the plain (Silvertown et al., 1999). However, it is difficult to find accurate cost estimations due to the relative rarity of rural cost estimations, which are often simpler in scope than those used for urban environments (Silvertown et al., 1999).

Regarding flooding itself, the impact on agriculture is highly dependent on the season and nature of the cultivation. Drew noted in 1983 that in many cases, summer flooding tended to be the most disruptive, due to complications with the harvest, and interference during peak growth (Drew, 1983). Hess and Morris (1988) further state that crop loss varies from a complete loss of root crops, eighty to one hundred percent loss in cereals, and significant

damage to hay and silage. On the other hand, damage to grazing crops is markedly less. Long-term summer flooding can lead to greater losses (Hess and Morris, 1988), with Posthumus et al. (2009), estimating the costs of the 2007 summer floods in England to be around £1207 per hectare, with damages being markedly less in winter. There is a period following flooding where land is inaccessible or too dangerous to utilise, further reducing the output of the area (Förster et al., 2008).

Flooding affects biodiversity as well, with some aspects requiring frequent flooding to maintain the natural state of the environment (Rouquette et al., 2011). Intensive agriculture requires that flooding cease, due to the adverse impact flooding has on crops. The result of this is that in rural settings, the various land uses are often mutually exclusive, and human modification typically comes at the expense of the natural processes that shape the floodplain. This denial of natural processes holds true for hydrological storage as well, despite previous research arguing otherwise (Jones, 2010). Rouquette et al. (2011) argued that the modification of the environment means that a system dependent on a shallow water table and frequent flooding will not function.

There are consequences for livestock too. As previously established, floodplains offer excellent conditions for agriculture and are often subject to engineering projects to increase their output capabilities, leading to the adoption of more intensive farming practices. Practices such as spreading stock effluent to increase grass growth can result in conditions where flooding leads to eutrophication and leakage of this waste, both from runoff and due to damage of storage facilities (Wing et al., 2002).

Floods also lead to livestock loss, particularly on farms close to water systems, as was the case in Nakhon Sawan province, Thailand in 2011 (Inchaisri et al., 2013). Moreover, prior to this, significant stock loss occurred in Pakistan during flooding in 2010 (Ashraf et al., 2013).

While the majority of literature around this topic is concerned with summer flooding, winter flooding is also an issue in New Zealand. European agriculture typically winters their livestock indoors (Hess and Morris, 1988), this reduces the risk of flooding impacts, but, this is not the tradition for a typical farm operation in New Zealand. Rouquette et al. (2011) discuss the use of rural floodplains, in any fashion, is typically the result of at least some form of engineering to make it fit for purpose. They use two examples from rural England, Beckingham and Kingsmarsh.

Based on the above, rural areas can suffer severe impacts from flooding. While these impacts are similar to those suffered by urban areas, the nature of these effects and time scales can differ wildly between the two. Based on this, differing approaches are necessary to accommodate local conditions.

2.3 FLOOD POLICY AND MITIGATION MEASURES.

Flood Policy has seen significant change and development following the Second World War. It has, generally followed the same direction, irrespective of location (Sayers et al., 2002; Baan and Klijn, 2004; Hayes, 2004). At the turn of the millennium, however, a growing embrace of new approaches and combinations for approaching flood policy and protection began. Driven by a range of factors including economics, population growth, and a shift away from central government to a local response that is more easily held accountable by communities. Consequently, the costs attached to large-scale protective works are no longer as viable as they once were (Mileti and Gailus, 2005). Increasing urbanisation also plays a role, with greater concentrations of people in flood-prone areas placing additional pressures. When combined with attitudinal changes in the population, such as an expectation that the government, national or local, will deal with the economic fallout of natural hazards, has meant that people are less likely to view flooding as necessitating a personal response.

2.3.1 HISTORIC POLICY

White and Hass in the nineteen seventies argued for natural hazard research to include a social perspective (White and Haas, 1975). This perspective included the economic, social and political spheres and the impact that hazards have within local and wider society (Mileti and Gailus, 2005), beginning a movement which took an interdisciplinary approach to flooding that sought to look beyond simple engineering solutions and embrace new technologies (Smith, 2013; Kitchin and Thrift, 2009). The new approach sought to introduce land-use planning into the equation, with the recognition that decisions made by governing organisations, both at local and national levels, could potentially reduce the effects of flooding and other disaster events before their occurrence, a view reinforced in the 1999 second assessment (Mileti and Gailus, 2005). This shift in approach can be seen around the world, in both developed and developing countries (Sayers et al., 2002; Ward et al., 2013; Hayes, 2004).

The result of this has been the creation of a field that draws on engineers, climatologists, economists and lawyers, with focus on the past, present and future of hazard events and their

impact (Mileti and Gailus, 2005), described as an interdisciplinary approach to flood management.

The 1980s are notable for the increase in focus on forecasting, and a new focus in design, which aimed to reduce the impact of hazard events on buildings, arise as a method of impact reduction. Burton (1993) criticises this movement as failing to address the implementation of these policies and the lack of public engagement and response to them (Burton, 1993). Burton also makes the point that policy around disasters was slow to develop, with much of the planning and response to hazards, handled at a local level. Therefore it is possible that part of the reason for the lack of public engagement during this period was due to a lack of available funding at a local level (Burton, 1993). This, coupled with the tendency for people to not consider themselves at risk from hazards, such as flooding, or make preparations for such an event without previous experience of a hazard event (Baan and Klijn, 2004; Siegrist and Gutscher, 2006), goes some way to explaining the lack of involvement among lay people.

Arguably, this reflected the top-down approach to governance that came, at the expense of community involvement. This is less common today, with the increased focus on involving lay people with the affairs of government, both on a local and national level (Taylor, 2007). Thus, the challenge of the 1980s may have related more to the way that the power structures operated, than with the way hazards were managed.

The following decade came with the recognition that the previous paradigm of achieving absolute flood protection was not achievable, due to the costs and associated uncertainties (Tanaka et al., 2011). This, in turn, led to a movement away from hard defence and reinforced the view first advanced by White and Haas. However, this is not to say that hard defences did not see continued use, with the new approach combining both methods (Tanaka et al., 2011).

Until the mid-point of the nineteen-nineties it was typical to manage hazards in isolation, that is there was little recognition of the interconnectedness of hazards, and the way humans interact and use the environment (Mileti, 1999). Thus, the attitude for much of history has been one where hazards are a problem to solve, rather than a phenomenon to be managed. This began to change in 1995 when a push began that called for approaching natural hazards with a sustainable management framework. This approach looked at hazards, not in isolation, but rather included the broader scale and incorporating risk perception and risk understanding into the discussion and management of hazards (Mileti and Gailus, 2005).

The Second Assessment (published in 1999) was the culmination of the above. It was derived from White and Haas' prior work and sought to combine hazard mitigation with sustainable development. The project, which involved hundreds of individuals from a variety of professions and fields, was headed by Dennis Mileti (Mileti and Gailus, 2005). At its core, it was a recognition that technology would not be able to provide a final solution to the problems of natural hazards (Mileti and Gailus, 2005). Many of the ideas advanced and championed by White and Haas were supported by the Second Assessment, which represented a sharp break from the traditional approach. Despite its growth, this process has not replaced the previous technological approach. In many cases, the merged approach that has grown in dominance over the twentieth century has continued. It is important to note that the ideas espoused by the Second Assessment are receiving increased focus and attention (Baan and Klijn, 2004, Sayers et al., 2002, Hayes, 2004, Ward, 2013).

2.3.2 CURRENT POLICY INTERNATIONALLY AND WITHIN NEW ZEALAND

In 2007, Johnsen et al. observed that the economic damages associated with flooding were receiving more attention than they had previously. This increased attention is a reflection of the increase in the intensity and frequency of flood events (Evans, 2004), as well as the previously discussed increase in human settlement of flood-prone areas (Penning-Rowsell et al., 2005; Howe and White, 2001). They also make the point that the new policy direction is at odds with the past and the natural human response.

Also notable about current hazard policy, is the scale. Warning systems and awareness, spatial planning, adaptation, insurance and emergency planning, as well as social costs such as health effects and vulnerability, need to be recognised (Johnson et al., 2007). The need to address these once again relates to spiralling costs in flood defence which has placed limitations on the capacity to provide hard defence measures.

International organisations also have had a role to play in the development of the current policy approach. The European Union, for example, was highly influential on the approach taken by the United Kingdom in the early twenty-first century. The Water Framework Directive (EU 2000), Habitats and Birds Directives (ECC 1992) and the Aarhus Convention on stakeholder engagement are examples of this. Particularly when coupled with the rise of cross-governmental policy in the wake of the Brundtland report and the subsequent interest and push for sustainability. Examples of this in the United Kingdom include the Sustainable Development Strategy and the Sustainable Communities Plan (Johnson et al., 2007). When

combined with growing wealth it has fuelled the change in the approach employed in regards to flood response (Evans, 2004).

The United States offers a different view to that of the United Kingdom. The United States, with its make up as a federation of States, leads to situations that are outside the experience of nations such as the United Kingdom or New Zealand. An example of this is the National Flood Insurance Programme (NFIP), a fund established by the Federal Government to provide subsidised flood insurance (Ntelekos et al., 2010). Increases in the scale and intensity of flooding over the last twenty years have led to the fund operating at a deficit. Before this, it was considered to have been largely effective (Sylves and Kershaw, 2004). While the United States was considered to have the most forward-thinking policy in the past, that is no longer the case, with academics arguing that the current policy does not meet the potential problems of the future (Ntelekos et al., 2010), suggesting a flat, centralised policy is not the solution.

Within the United States, the State of California has a long history of flooding. The aftermath of Hurricane Katerina brought home the risk that was inherent in settlement of the Central Valley, with Sacramento becoming the “Greatest flood risk in the United States” (Brandt and Clark, 2012), leading to a greater perception of risk within the state.

The outcome of this greater understanding changed the land use regulations on the floodplain, taking the form of proposals to limit development on floodplains, as well as promoting system integration, coupling state leadership and local participation, mirroring the approach that has developed in Europe (Brandt and Clark, 2012). The overall effect being a shift away from an adversarial attitude to floods, and towards one where the impacts or damages of floods were managed, rather than persisting in an attitude that sought to defeat an inevitable natural process (Brandt and Clark, 2012).

Within New Zealand, since the year 2000, there has been much discussion around hazards and at risk communities, including commentary that communities which are at risk should be relocated (Glavovic et al., 2010). With this has come the recognition that the solution, ultimately, lies in land-use planning, mirroring the approach of both America and Europe. Again this is indicative of a shift in attitude, as the previous method of control relied heavily on Central Government action and a network of preventive works (Glavovic et al., 2010; Ericksen et al., 2000; Day, 2005). This shift is of particular relevance to urban centres such as Palmerston North and Lower Hutt which exist on flood plains (Glavovic et al., 2010).

Within this context, legal changes such as the Resource Management Act (1991) and the Local Government Act (2002) have fundamentally altered the situation, with many duties devolving to a local level. Glavovic et al. (2010) make the point that in this setting, hazard risk and prevention must compete with economic and social concerns which may prove to have a stronger appeal than reducing development (Glavovic et al., 2010). Land use planning occurs on three distinct levels in New Zealand and incorporates many stakeholders. Figure 2.3 below illustrates these stakeholders.

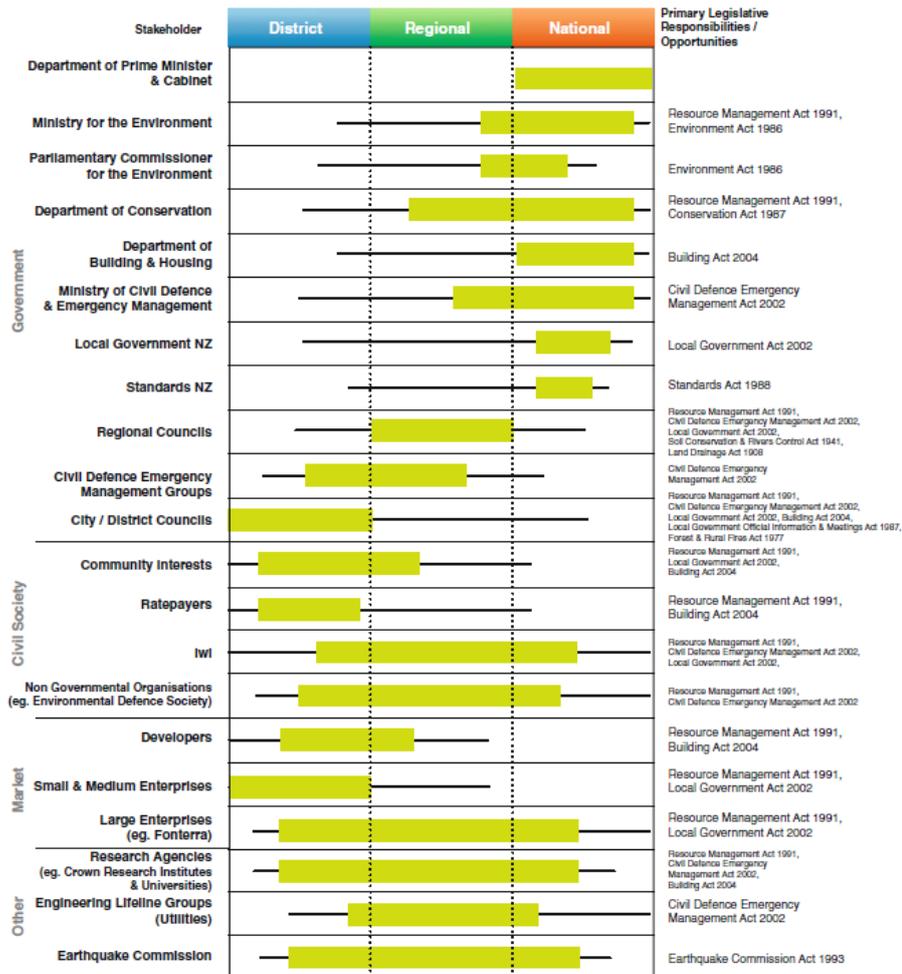


Figure 3: Stakeholders with an interest in land-use planning for natural hazards taken from Glavovic et al. (2010)

While there are issues with the New Zealand system, it is representative of the change in policy from the past to the current state where the inter-connectedness of the community and hazard risk reduction is recognised and are increasingly allowed to voice their views on the issue (Glavovic et al., 2010).

However, barriers remain. These are largely universal and relate to the tendency for communities to favour the immediate and direct effects at the expense of the long-term (Berke, 1998). The exception to this is when a hazard has recently occurred, as evidenced by the work of Kreibich et al. as well as Baan and Klijin (Baan and Klijin, 2004; Kreibich et al., 2007). Glavovic et al. (2010) indicate that there may be influence from higher level planning documents that remove the motivating factors for local government to seek to make their communities hazard resilient. They argue the solution to this is to seek greater coordination among the different levels for planning documents and policies. The third issue is that this coordination is difficult to achieve, with Godschalk having already explored this issue in the American context (Godschalk et al., 1998). Such a transition has several implications for New Zealand, considering the variability concerning the use of government documents, as well as regional and local variability. Finally, the issue remains that the dominant view currently held is to promote economic development and growth, regardless of the level of exposure to risk. The continued settlement of floodplains around the world, despite the dangers, reflects this, and is an issue difficult to solve (Godschalk et al., 1998).

Planning clearly has a large role to play in flood resilience. New Zealand is following a similar path to the rest of the world in moving away from the protective works favoured previously. Devolution from the Central Government also presents several potential solutions. However, such a shift faces numerous barriers. The greatest of these, according to Glavovic et al. (2010), is a lack of communication among the various stakeholders and a failure by the central government to provide an overreaching policy path to follow. Glavovic et al. (2010) view these communication and guidance issues as the greatest failing concerning hazard planning in New Zealand.

2.4 RISK AND HAZARD MANAGEMENT

Risk Management refers to the approach that has been adopted by government bodies to manage environmental problems. Essentially it means making decisions based on the frequency and scale of events and their effects (Rothstein et al., 2006). This approach draws heavily from scientific understandings of events and locations, which can also lead to situations where policy and regulation demand an answer that is not yet sufficiently understood, or an approach that lacks evidence to support it (Rothstein et al., 2006). This reliance on supporting data is made all the more difficult in environmental fields due to risk-based approaches only recently having been adopted (Gouldson et al., 2009). Additionally, stakeholders are likely to have differing

views and attitudes on what is considered acceptable risk. Plate (2002) states that the advantage of risk management lies in the multiple levels it operates on, which allows for the system to react and adapt to situations when people are not having their needs met, either through changes in land use, population growth, or otherwise.

2.4.1 RISK PERCEPTION

Risk is considered quantifiable, and the most widely recognised definition uses an equation to express risk as probability multiplied by negative consequence (Raaijmakers et al., 2008). However, Aven and Kristensen have argued that risk is both a way of expressing uncertainty and as a way to group a series of perceptions, risk then becomes a judgement rather than a measurable fact (Aven and Kristensen, 2005). Probability then becomes a catch-all for the knowledge available, which in turn is dependent on the information of the individual making the judgement (Raaijmakers et al., 2008). When applying risk to flood management, it refers to the understanding and knowledge held by the processes of the system and the likelihood and frequency of flood events.

Based on the above, it is clear that different people would perceive risk, particularly flood risk, differently. Messer (2006) identifies a difference between people living in at-risk areas and those who are not (Messner and Meyer, 2006), While Baan (2004) identifies a separation between those who have experienced recent flooding when compared to those who have not (Baan and Klijn, 2004). Additionally, there is a difference in how experts and lay people view flood risk (Siegrist and Gutscher, 2006).

The relationship between risk and perception is complicated. Siegrist and Gutscher (2006) suggested that there was minimal correlation between risk perception and how prepared people were for a disaster, with Perry and Lindell (2008) echoing this. Becker et al. (2014) found some level of correlation in their study of flood-prone areas along the Rhine, which showed a reasonable level of concern in regards to flooding, although personal experience again played a role in individuals overall attitudes (Becker et al., 2014). Overall, the conclusion is that there is a significant emotional factor involved in risk perception and subsequent preventive action that was not readily explainable, a view echoed by the findings of Lindell and Hwang (2008) (Becker et al., 2014). Additionally Grothmann and Reusswig (2006) indicated that past flood experience was connected to future preventive response among lay people.

The above shows the importance of risk perception in shaping and guiding the actions taken by individuals, and serves as a useful guide for decision makers. However, it makes understanding a group and their actions difficult, particularly predicting and quantifying potential actions (Mileti and Gailus, 2005; Raaijmakers et al., 2008).

2.4.2 ACCEPTABLE RISK

Acceptable risk refers to the level of risk that individuals are willing to accept as part of their daily lives. Over the years, research has indicated that people are less likely to put up with a consistent, low-level risk, than a more serious risk, that occurs less frequently (McCarthy et al., 2006), an observation also reflected in the findings of Kilvington and Saunders (Kilvington and Saunders, 2015). Additionally, Lindell and Hwang (2008) found that the emotional impact and experience of a hazard event was a better predictor of preventive action and future risk awareness than income or house ownership. Smith (2013) found that this increased awareness typically resulted in an increased demand for additional protective works, which mirrored the findings of Kreibich et al. when researching hazard awareness following flooding in Saxony (Kreibich et al., 2007).

The reactions of residents in the Netherlands following flood events illustrate this. Baan (2004) established links between the flooding that occurred in 1993 and 1999, and an increased awareness of flood hazards in the affected areas (Baan and Klijn, 2004).

Despite understandings of risk rising in the aftermath of events, it has been observed several times, that risk understanding overtime declines alongside memories of the event (Siegrist and Gutscher, 2006; Catto and Parewick, 2008; Tully, 2007). This decline drives the need for communication within the wider context of flood risk management.

Many people decide to live in an at-risk area. While there is an argument to be made about individuals lacking an understanding of the risks and the potential consequences (Kilvington and Saunders, 2015), for many the benefits outweigh the costs. These could be due to employment opportunities, such as is likely the case for urbanised floodplains or due to other concerns such as property located close to a water body (Mileti, 1999). These complications add a level of subjectivity to the topic, as there may be varying levels of acceptable risk that differ between communities and individuals. Internationally, insurance schemes allow for these differing levels of risk to be managed, providing mechanisms for those who deem the risks associated with in the area acceptable (White et al., 2001). In New Zealand, the Resource

Management Act of 1991 allows for a variety of different land uses, providing that the local authority is willing to accept the consent application.

2.4.3 FLOOD RISK MANAGEMENT

Flood risk management refers to the combination of prediction, assessment and land-use planning and risk reduction strategies (Merz et al., 2010; Schanze, 2006b). Because it draws on a wide range of disciplines and roles, it also involves coordinating with a wide range and number of stakeholders. It is a system always in flux with new analysis and re-assessment of the hazard, either through shifting land uses or new data creating a dynamic system (Schanze, 2006b). Despite the adaptability of the risk-based management system, it is not a solution by itself. The solution for this is to combine the management system with a flood control scheme, which requires some degree of maintenance. In addition to this continuous cost, there is the risk that an event will prove greater than the defence, something which some have argued is inevitable (Tanaka et al., 2011). Plate (2002) argues that risk management allows for a backup system which reduces the effects of this, although flooding will always have an impact, either economic or social in nature.

In many ways, risk assessment embodies much of what White and Haas advocated in their 1975 publication 'Assessment of Research on Natural Hazards'. The nature of risk assessment seeks a technical and collaborative environment, and policy objectives shape decisions (Evans et al., 2006). Plate illustrates this with an example of the engineer who looks at a defensive work as a pure engineering project, ignoring the complexity and different disciplines that are involved in flood defence at the different levels (Plate, 2002).

Plate (2002) defines flood risk management as "In a narrow sense [it] is the process of managing an existing flood risk situation. In a wider sense, it includes the planning of a system, which will reduce flood risk." (Plate, 2002, pg 3). Wheeler and Evens (2009) support Plate's findings, articulating in their 2009 article that land management, social and economic factors play a key role in ensuring a robust system of flood management. These publications make a convincing case for the inclusion of affected communities, and society at large in the process to hear their perspectives.

Plate (2002), breaks flood risk management down into three distinct areas. The first of these is risk analysis, which functions as the basis for the current flood protection scheme and the long-term management of the hazard (Plate, 2002). Reassessment ensures data is accurate and to

identify any variables that have changed since the previous assessment, and combined with an assessment of risk vulnerabilities. This mechanism identifies what areas and resources are at risk during an event as well as the frequency of risk exposure the areas will experience, allowing for a system better able to manage risk (Schanze, 2006b). Geographic Information Systems (GIS) have increasingly come to dominate this area, with its use allowing the development of high-quality hazard and risk maps (Plate, 2002). As data collection improves and experience increases, the risk can then be further adapted to and improved by adjusting the response to future floods. Image 2.4 summaries these findings.



Figure 4: Stages of operational risk management, taken from Plate, (2002), adapted from Eikenberg, (1998)

Plate (2002) makes specific reference to early warning systems, considering them among the most critical factors that need to be consistently improved and managed. New technologies, in particular, mean that improvements to the systems are consistent and able to better deal with future flooding.

However, decisions are likely to be influenced by cultural and economic factors, not just what is the most efficient way to reduce risk concerning flood threat, complicating the system. There is a personal element as well, with the individual analysing the data subject to their own, personal evaluations of risk (Schanze, 2006b). This, in turn, leads to risk reduction.

Risk reduction exists in three distinctive stages. Pre-event, flood-event and post-event (Schanze, 2006b). Pre-flood reduction methods are concerned with mitigation. Whereas during the flood event management involves carrying out a response planned before the event (Schanze, 2006b). Post-flood event methods are concerned with the recovery from the flood (Schanze, 2006b). While this received the majority of focus in the past, Schanze argues that it has largely fallen

out of favour due to the costs. Increasingly, the focus is shifting towards mitigation particularly in regards to land-use planning (Mileti and Gailus, 2005).

2.4.4 LAND USE PLANNING

Land use planning is focused on reducing the impacts of flooding and occurs at both the local and regional level (Burby et al., 1999). Burby makes the point that significant savings, both monetary and in human lives are possible if “Government worked to keep people out of flood’s way by discouraging development in hazardous areas...”(Burby, 1998, pg 9)

In recent times there has been growing interest in using land-use planning to manage hazards internationally (Burby and French, 1981; Chang and Hsieh, 2013; Godschalk et al., 1998; Posthumus et al., 2008; Pottier et al., 2005). New Zealand itself faces challenges in that to complete the shift towards a risk-based approach there is a need to define acceptable, tolerable and intolerable risk, as well as how to approach communities that have developed in areas exposed to hazards (Saunders and Kilvington, 2016).

Intensive development encourages continued development, due to expectations that these areas will see continued protection, thus attempts to change this are perceived as a detriment to economic growth (Burby et al., 1999). There is a human element as well, with people typically being reluctant to leave their homes following events (Baan and Klijn, 2004). Even in situations where development is halted or at least slowed, this does nothing to reduce the risk faced by those already living there, reflecting White's previous findings (White, 1958).

A final point is that, particularly in the case of flooding, data is variable, and events can develop and change quickly. This variability reflects the degree of uncertainty in science. Additionally, as Downton et al. (2005) observed it is difficult to make a long-term prediction based on data collected over a much shorter period. Communicating with lay people and explaining science to those without a scientific background has always been difficult. The limited spread of science outside of those within its specific field further complicates this and results in a great deal of difficulty in influencing local policy (Liverman, 2008). There has been a concentrated effort to change this, which has seen some success in the Bay of Plenty, thus indicating the potential for this difficulty to be overcome with time and effort (Kilvington and Saunders, 2015).

2.5 FLOODING IN FUTURE CLIMATES

Flooding is heavily dependent on both hydrological and metrological processes (Whitfield, 2012). Is it agreed that the changes in atmospheric conditions over the next several decades will contribute, and may already be contributing to increases in both the frequency and intensity of flood events as shown in figure 2.5 below (Mahmood and Ullah, 2016; Milly et al., 2002).

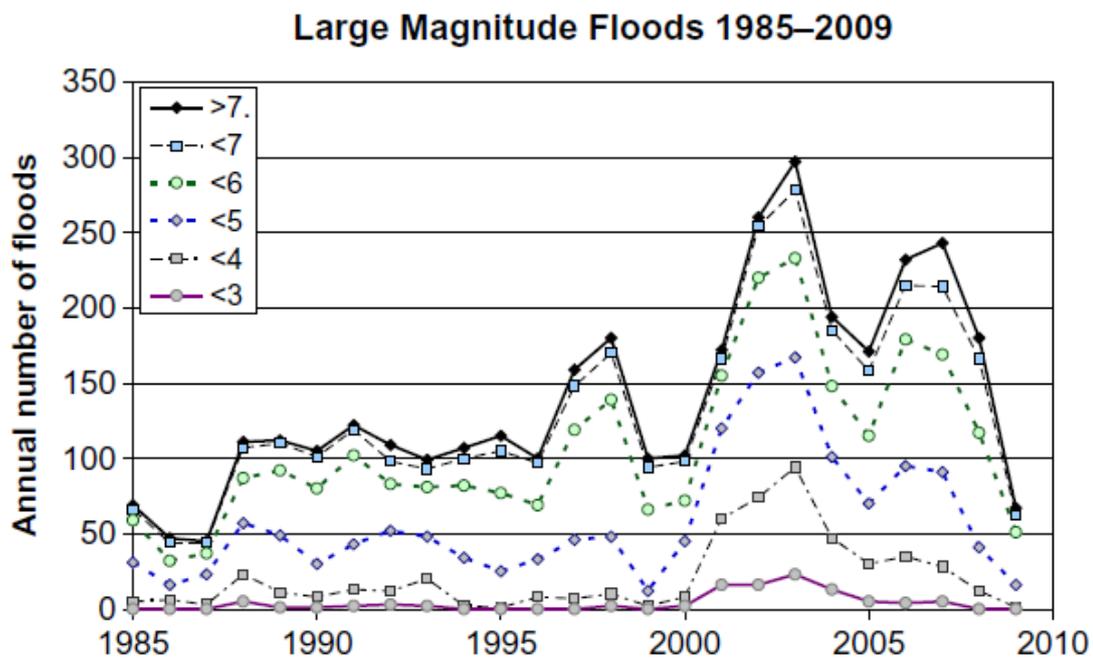


Figure 5: Global large magnitude flood events from 1985-2009 taken from Brackenridge (2009)

There are many reasons for why people have come to settle in and around floodplains, mostly due to ease of access to resources, initially in the form of drinking water, but today this has expanded to power generation and easy access to transport. This reliance leaves people exposed to flood hazards, and as population growth continues, this in turn, means that more people will be exposed to more frequent and intense hazards (Whitfield, 2012). This potential increase in exposure is one of the major dilemmas facing land use planning and can be seen both in New Zealand and around the world. It also shows that land use planning cannot successfully solve the issues around climate change and flooding by itself.

2.5.1 FLOODING AND CLIMATE CHANGE

Two differing views define the relationship between flooding and Climate Change. The IPCC has noted that a warmer atmosphere would potentially lead to increased precipitation, and the trend has been observed previously (Intergovernmental Panel on Climate Change, 2014). The other argument is that the increase is tied to greater populations of people exposing

themselves by settling in at-risk areas (Whitfield, 2012). Kron and Berz (2007) in their analysis suggest that there is a climatic component and there is a strong likelihood that there are elements of both factors at play, rather than a case of one or the other, notably the IPCC has not recorded a consistent increase in flooding (Whitfield, 2012).

This variation in opinion illustrates the difficulty in coming to a firm conclusion about what effects the changing climate will have on floods. Due to these different conditions and environments in which they occur, floods will respond to climatic changes in different ways, which in turn means a broad conclusion is difficult to arrive at (Whitfield, 2012).

2.5.2 COMPLEXITIES OF STUDYING FLOODS

Because floods are rare events, it is difficult to gather accurate data, and this is further made difficult by the unique nature of flood events. Traditional study of floods accordingly makes many assumptions and estimates at the base of each study (Whitfield, 2012).

One of the main issues with flood research is the difficulty in collecting accurate data. Whitfield (2012) states that while observations of flood events are relatively common, data collected during these events are scarce due to the danger, accordingly, there is a high degree of inconsistency with the gathered data. Additionally, different technology is used to measure flood discharge compared to when 'normal' measurements are made. Potter and Walker (1981) found that when the discharge is at a certain point, indirect measurements are used to estimate flood discharges, further limiting accuracy.

In addition to the difficulty in gathering data during flood events, there is a high degree of variability in each flood. This variability comes from differences at the watershed, regional and national level which makes it difficult to make sweeping conclusions (Whitfield, 2012).

Consequently, predicting future flooding through models is made difficult due to the lack of easily available and consistent data from the present. Whitfield (2012) also makes the point that it can be difficult to separate the effects of a changing climate from those of changing land use in flood-prone areas. The greater uncertainty around future flooding when compared to climate uncertainty reflects this (Whitfield, 2012). Models are difficult to use at a high level due to the lack of consistency in catchments. Additionally, individual catchments and their flood potential are more closely related to land use than it is to hydrological or metrological events,

further contributing to the complexity and difficulty in statistically assessing change over time (Whitfield, 2012).

The result of this and a key issue at the heart of future flooding, is the difficulty in gathering accurate data and using that data to build a comprehensive model capable of tracking the effects a changing climate will have in isolation from other contributing factors.

As demonstrated above, the hazards of flooding have in the past been overcome through engineering, with dams and dykes playing a large role in securing areas of settlement. As the climate changes, the data these structures use to meet the needed requirements are no longer necessarily correct. Where once a dam that could withstand a one in one hundred year flood without issue, the area may now experience a one in two hundred year flood frequently, requiring a new dam or extensive modification of the old one. Jarrett and Tomlinson (2000) explored this with their study of the Olympus dam in Colorado which saw the initial estimate of the Probable Maximum Flood (PMF) expand to almost four times larger than its initial estimate. The changing climate also raises questions about the calculations used in the design of these defence features. Whitfield (2012) argues that with every flood being somewhat unique, it is difficult to design a system where either the PMF or the Probable Maximum Precipitation (PMP) approach will yield consistent and accurate data.

Thus, from an economic and defence perspective, changing climatic conditions will likely lead to high levels of flood damage, as existing defences fail, or a vast increase in defence costs, paying for defences that even when improved, may in fact, be based on erroneous or out of date data.

Another effect is the potential for a change in the flood threat. Where once flooding may have come from meteorological events, there is a chance that a catchment would shift towards hydrological flooding. This risk can also be seen in the potential for formerly frozen rivers to cease to lock up water in winter months, leading to increased discharge downstream and increased chances for flooding (Whitfield, 2012). The difficulties associated with predicting future land use, further complicate this issue which also has a role to play in determining the impacts.

Current land use also raises questions. As has been previously established, there is a high degree of settlement in areas that are currently at risk and there exists the potential for climatic change

to affect the long-term viability of continued human settlement in these areas. Changes to the climate, in turn, will require changes in urban design and settlement, as well as the movement of large numbers of people away from at-risk areas and into regions that are not affected by the changes, brought about by the shifts in the weather. South Dunedin is one example of these at-risk areas.

This movement will, in turn, require new risk assessments and development to accommodate these movements and the potential exists for this to put a strain on existing communities and settlements, contributing to additional issues arising in areas not exposed to flooding.

2.6 SYNTHESIS

Flooding has a significant impact on the land and people where it occurs. Differences in land use, including the division between rural and urban population and the local economy in these areas, in turn, mean that different considerations are required when accommodating and planning for flood hazards. These variables have the result of requiring different methods and considerations depending on a range of factors, including population and building density as well as ground permeability and vegetation cover. While there are urbanised rural areas and areas within and around urban centres with little development, a separation between the two settings is easy to make.

Within New Zealand, there are several highly urbanised regions as well as regions that are highly rural in character. This aspect of the country, in turn, means that regions can be expected to face different issues arising from flooding, and require different management strategies to defend residents and the immediate environment around them effectively. These differences then, inform decision makers about what is required for flood management to be effective in meeting the needs of the people living in the area. As a result, the local environment plays a key role in determining the shape and direction of flood policy in a given area.

Flood policy has also changed significantly following the conclusion of the Second World War. This transition is reflective of the changing priorities of governments, which have shifted from the initial approach which prioritised maximising the amount and availability of land to build and use for agriculture, towards a more environmentally conscious approach.

Over time, there has been a gradual realisation and shift away from an adversarial approach to flooding and towards one which emphasises living with flooding. This shift has had the result of promoting a more holistic approach towards flooding. This holistic approach has seen flood management shift away from hard defences and an approach that was dominated by engineers, to one which places a growing emphasis on using land control and education to provide people with the resources to better understand the river systems they live in, and flooding in general.

This new approach is not without issues, however. Historical settlement patterns have often resulted in the growth and development of communities that are themselves heavily exposed to flooding, leading to significant defensive works which have encouraged settlement in exposed areas while requiring continued investment to maintain. This is a factor which is likely to lessen over time, as financial constraints and the lack of viable projects will lead to a decrease in the development of new projects while financial constraints will encourage a greater focus on social and policy-based approaches.

A key part of flood management is risk communication. Risk is a difficult concept to understand and explain further complicated by the tendency for people to have differing ideas of what level of risk is acceptable. This then makes a broad, overarching approach difficult to implement while pleasing everybody and meeting their needs. There are opportunities here to develop communication around risk, both with individuals and with the larger community, which would have the benefit of allowing for an approach which is better able to account for the views of the community on risk and the interactions around it. As a result, flood management needs to accommodate risk, while at the same time communicating the concepts behind risk to the public to ensure that they can understand the mechanisms which are guiding policy. Land use planning can be used here to ensure that areas which are exposed to significant risk do not see significant development, which would limit the risk to people as well as reducing costs regarding hard defences and clean-up costs following events.

Climate change and the changes it bring with it to flooding generate significant uncertainty when planning for future flooding. Increases in the frequency and intensity of events mean that previous defences may no longer be able to withstand the level of events that they were designed for, while more significant events can be expected to occur more often, further raising costs. Uncertainties around data and the accuracy of models in the long term further complicate planning for future events due to the lack of specific information which can be used to provide guidance. A secondary factor to consider in regards to climate change is the impact that it will

have on risk. Areas that were previously at no risk or little risk of flooding may see an increase in the probability of flooding, while high-risk areas may see flooding become a more significant factor than it currently is, perhaps requiring the abandonment of some current residential areas. There are also implications regarding insurance, as costs will likely rise as flooding becomes a larger factor in daily life or even insurance companies coming to consider flooding something which can be expected and prepared for, which will, in turn, have significant impacts on people and the type of insurance they can get.

3 METHODOLOGY

3.1 INTRODUCTION

The following chapter details the methods used to conduct this research into New Zealand flood management. Two case study sites were chosen, supported by key informant interviews and an analysis of relevant documents. This allowed for exploration of the theories and concepts discussed in chapter two within the New Zealand context, aiding in understanding the attitudes and views expressed by the key informants.

3.2 THE CASE STUDIES

Due to the nature of the research topic and the need for in depth discussion to be held with participants, a qualitative approach was adopted. The need for in depth discussion was driven by the scale and variety of the topic, as well as the influence of local conditions in influencing flood events. Consequently, speaking to individuals involved at the local level allowed for detailed discussion of these factors which are difficult to measure quantitatively. The case study approach is a recognised qualitative design, and as with other qualitative approaches seeks meaning and understanding, using the researcher as the primary means of data collection and analysis (Merriam, 2002). Additionally, Williams (2011) states that qualitative data methods allow for discovery during the research process (Williams, 2011). Because of this, the case study approach was chosen.

The use of a single, or, in this case, multiple case studies is a widely accepted practice within the social sciences, in part because it requires relatively few resources and can be conducted by a single person (Feagin et al., 1991). Due to the limitations of this study, particularly regarding time constraints, these factors are of direct relevance.

The two case studies were approached as instrumental case studies, as the case studies themselves are secondary to the main focus of the research, namely how local experts understand and approach risk management in the context of flood management (Stake, 2000). The case studies play a supporting role to the main research focus. Both Otago and Whanganui-Manawatu are representative regions of New Zealand, featuring heavily urbanised and rural areas, allowing analysis to include varied areas with which to explore risk management in New

Zealand (Stake, 2000). Thus any recommendations made with other regions in mind were secondary to the primary aim of the research.

Both Otago and the Manawatu experienced significant flood events in 2015 (Otago Daily Times, 2015, New Zealand Herald, 2015). In addition, flood events occur in both regions, the Manawatu experiencing a significant event in 2004 and Otago encompassing a number of flood prone areas such as the Taieri plains (Stowell, 2016). These experiences mean that experience with flooding is common, both among professionals and lay people. Additionally, the relative frequency of flood events means that mechanisms are and will be developed to better manage and cope with flood events.

3.3 DATA COLLECTION AND ANALYSIS

Several methods were used to collect data. Including interviews with key informants and a document analysis of relevant publications.

3.3.1 FIELDTRIP

A fieldtrip to the Whanganui-Manawatu region was conducted in mid-July of 2017, in order to see and experience the area and the river and water systems that operate there. The other purpose, was to allow for face to face interviews to be conducted with key informants in the area. The trip consisted of interviews alongside intermittent site visits which were accomplished via a private vehicle.

3.3.2 INTERVIEWS

Interviews are an important source of information when conducting case studies. The reason for this is their ability to identify relationships and the context around which these relationships develop. Interviews also allow for the further development of the how, what, where and why (Crowe et al., 2011). Interviews were conducted with individuals who were identified as key informants, with the interview following a semi-open ended structure. Yin (2003) makes the point that key informants can offer their own insights and propose different and new avenues of research that can be pursued, making them a useful addition to any research (Yin, 2013).

Informants were carefully selected. Initially, a list of relevant professions and groups was made, based on the importance and relevance of their role in relation to hazard management in the chosen regions. Individuals directly involved in hazard management roles were identified.

These individuals were then approached in writing, with a description of the research and what it hoped to accomplish and a request to be a part of it. At this time consent forms were provided as well.

Individuals were chosen based on the relevance of their roles to the subject matter. This meant either direct management, or due to their position in organisations that had a role that directly related to flood management. These individuals were found either due to research into prominent figures at the locations or through contacting the organisations and working with them to identify people who would be best placed to answer the interview questions and develop the research. In total sixteen interviews were conducted across all identified organisations. With five interviews from individuals in and around Otago and eleven in the Manawatu from each group. Appendix A lists the abbreviations used to identify each informant and preserve their anonymity.

While every effort was made to include the relevant organisations and individuals, there will always be gaps and missed opportunities. To remedy this, a key question raised in each interview was who the informants considered a critical or major part of managing flooding and associated hazards. The intention was to gather an impression of how the people on the ground perceived the various organisations and individuals involved, and explore what they perceived hazard management in practice looked like. These discussions identified further potential key contacts and efforts were made to reach out and engage with them, this was successful in three cases. The overall aim of this process was to gather data of a high quality with which to engage in analysis (Lindsay, 1997).

As previously noted, interviews can reveal more than just words can (DeLyser and Sui, 2014). The semi structured format of the interview allowed for a degree of flexibility on the part of both the researcher and the informant, while still allowing for a broad structure to shape how the interview was approached. It also allowed people to communicate their thoughts and feelings about the question topics to a greater degree than otherwise (Packer, 2010). This allows for more flexibility than a more rigid interview structure would (Lindsay, 1997). Kitchin and Tate (2000) also point out that this style allows for previously unidentified gaps to be filled without the researcher needing to be aware of them (Kitchin and Tate, 2000).

There is a risk that the lack of structure leads to key topics and interesting discussions being overlooked or ignored, and issues may arise when attempting to compare interviews and the

data within them (Kitchin and Tate, 2000). While these issues are recognised, it was judged that there was greater benefit in allowing the key informants, experts on this topic, the freedom to speak about issues as they wished and allow for their perspectives and views to come through, creating a more nuanced and complex understanding of the “on the ground” situation in regards to flood management.

Interviews were conducted face to face, at a place of the key informants choosing, in order to allow for a more personal connection to be developed between the researcher and the key informant (Kitchin and Tate, 2000). In cases where this was not possible, interviews were conducted via phone. Audio recordings of interviews were taken for all interviews. These recordings allowed for greater understanding of the data and concentration on what the informant was saying and how they viewed the topics discussed (Kitchin and Tate, 2000). In order to lessen the risk of data loss, a written record was also made.

The interview questions were non-leading questions so as not to influence the answers provided, Appendix E contains the guiding questions used. Where it was felt that the informant did not provide enough detail, or new information was revealed, further questions were asked. May (2011) makes the point that this style of questioning does risk interfering with the objectivity of the interviewer and the information presented (May, 2011). However, every effort was made to ensure that this was not the case.

The interviews were then transcribed. This allowed for a more comprehensive and intensive study of the data. Coding of the interviews was used, in order to identify major themes that were common throughout each interview. This method follows the traditional approach to the use of coding, using it to highlight links and connections through the collected data (Packer, 2010). A total of seven codes, of which four, (Communication, Policy, Resources, Knowledge/ Understanding), were considered to be of major significance to the research were identified. Appendix B includes the complete list of codes used in the research.

Due to the involvement of a number of businesses and organisations. There is a risk that the key informants will choose to adopt a view and approach which will not risk alienating or complicating the relationships they have developed with the community and other organisations. The use of probing questions is hoped to be able to overcome this issue. Personal bias on the part of the key informants has also been identified as a potential issue. This may

come from personal experience with the other organisations or with individuals. To overcome this issue, both organisational and personal relationships were kept separate from the other.

In order to ensure the accuracy of the data collected, the research employed the use of triangulation. Triangulation improves the validity of data through comparing data from several methods (Fielding, 2012). In the case of this research triangulation was achieved through comparing comments made by key informants in interviews with those made by other informants and in local and central government documents, including regional and district plans. The role of triangulation in ensuring validity is further supported by the comments made by Hesse-Bilber who specifically notes the role of triangulation in ensuring the reliability and validity of data (Hesse-Biber, 2010).

3.3.3 DOCUMENT ANALYSIS

Due to a major focus of the research investigating on the way that local authorities responded and managed the threat of flooding, planning documents were a major cornerstone of the research. Documents that were used for this study included the Horizons One Plan, Manawatu District Plan, the Otago Regional Policy Statement, Otago Regional Water Plan and the Dunedin City Plan. Documents were chosen based on their relevance to the subject matter. Local government documents are useful in terms of providing an avenue to examine how the local geographical context informs the policy and decision making process in these areas (Kitchin and Tate, 2000). A method was developed using components identified as important to flood management practices identified by the New Zealand Ministry for the Environment (King, 2010, Woods, 2010). The detail of the approach used is discussed in chapter four.

3.4 CONCEPTUAL FRAMEWORK

This study was conducted and processed through a conceptual framework. The use of a conceptual framework is recommended as it assists with keeping the research on track (Smyth, 2004). It does so by linking the literature to the research, informing the research design, providing a reference point for discussion and analysis of the data and contributing to the trustworthiness of the research and data (Goetz).

In terms of the research presented here, the overriding aim was to focus on flood hazard management as it currently exists in New Zealand, through a snapshot of two different settings. Then, using this as a basis, it aimed to examine the likely future trajectory of this management

system in respect to risk based management, taking the potential changes brought by climate change into account.

Interview questions and document analysis were informed by these goals and shaped the overall approach and attitude to the research.

The Literature Review (chapter two) has played a key role in shaping the direction and nature of the questions which this research seeks to answer. The identification of four major themes: rural and urban flooding; flood policy and mitigation methods; risk and hazard management; and flooding in future climates has identified key factors in shaping past, present, and future responses and methods to flood management. The nature of these topics has played a role in shaping the development of the approach taken to collecting data for analysis and the methods employed to do this. In addition, these topics have shaped the general direction of the questions which the interviews sought to answer. The general shape of these questions can be seen in Appendix E.

3.5 ETHICAL CONSIDERATIONS

Ethical considerations are an important factor to consider, in particular, the researcher should continue to consider and keep ethical considerations in mind at all times while researching in the field (Sultana, 2007).

Tolich and Davidson (2011) stated that in order for research to be considered ethical there are five ethical principles that it should aim to meet. These are: voluntary participation; informed consent; do no harm; avoid deceit; and provide confidentiality or anonymity (Tolich and Davidson, 2011). These considerations were used as a guide when designing the research approach for this thesis and ensuring that it would not breach ethical practice.

While conducting this research, all efforts have been made to ensure that the research is ethical. This was made possible by following the University of Otago's Ethics B guidelines and submitting an ethics application. Ethical approval was granted on 24/05/2017. By following the ethics process developed by the University of Otago, all ethical considerations of the research were assessed and approved by a departmental approved assessor.

When individuals were sought for Key Informant interviews, participants were provided with an information sheet detailing the thesis scope and information relating to why they were

approached. Informants were provided with an outline of the key questions, and a consent form that they were required to sign prior to the interview. The information sheet, consent form and outline questions are attached in Appendices C, D and E.

3.6 CONFLICT OF INTEREST AND BIAS

The research conducted by others has highlighted the increased likelihood of widespread flooding in future years. This, alongside increased population pressure and occupancy of flood prone areas shows the relevance and suitability of this topic as a subject of study. A point reinforced by widespread flooding in the North Island in the early part of 2017. It should also be noted that I have a personal interest in hazard planning, although prior to undertaking this research I had only a broad and limited understanding of the subject.

To avoid bias, I choose two areas that I have little personal attachment to, although I do have family members who continue to live in the Manawatu district. While this connection may have highlighted the effects of flooding in rural districts, I believe that I am sufficiently removed from these events that, provided I remain aware and self-critical of my assumptions, this will not jeopardise my data collection.

3.7 LIMITATIONS OF RESEARCH

The limited scope of the research, focusing as it did on two regions, means that there are major difficulties in extrapolating the data to other parts of New Zealand. This limited scope is the most significant limitation affecting the research and this is further exaggerated by the fact that the document analysis was further limited in scope, choosing only documents which were considered to be the most important at the local level. This meant that important documents at the national level as well as axillary documents at the local level were not analysis which has resulted in the research lacking the accuracy it would have enjoyed had a more comprehensive analysis taken place.

A further limitation can be found in the Informants. While Informants came from a range of backgrounds and localities, there was often only one representative of their disciplines, as seen in Appendix A. This has meant that it is difficult to tell if the comments made by informants are representative of the industry as a whole or simply the personal opinion of a single figure in that industry. Additionally, there was a significant divide between the informants from the Manawatu and those from Otago, As a result many of the comments made by informants were

intended to reflect the state of the Manawatu and not that of Otago. The result of this is that the findings of this research favour and have more relevance to the Manawatu and the conditions there than they do to Otago.

The result of the above limitations is that the research has, overall, a limited level of generalisability. Due to the heavy reliance the research has on qualitative research, less focus is placed on generalisability and instead places emphasis on interpretations of meaning (Schofield, 2002). This has the result of making the overall product of the research less focused on achieving a generalised overview of flood management in New Zealand, or rural and urban environments, and instead focuses on the specific conditions that Otago and the Manawatu face when managing flooding in these regions. Therefore, while there may be shared elements between these regions and other parts of New Zealand and the world, there are significant limits on how many links can be made between these areas due to local geographic considerations.

3.8 CONCLUSION

The procedures and method adopted here have been chosen as they provide the best means to conduct research in an accurate, useful and efficient manner. The methods employed, fieldwork, interviews and document analysis provide a strong basis upon which to build the research and draw conclusions.

This chapter has described and justified the methodology that was employed and the conceptual framework that was employed to shape and guide this research. This framework has provided a clear line of development from the literature review to the later chapters of this thesis. The next chapter provides a broad overview of the two study sites and the context that shapes the styles of flood management employed by the governing bodies for these districts.

4 FLOOD PROVISIONS IN PLANNING DOCUMENTS.

4.1 INTRODUCTION

Planning documents serve as a way to shape and inform both policy and the approach taken by councils regarding a range of issues, including flooding. They also show how legislation guides how local government manages flooding in New Zealand, documents such as the Local Government Act 2002 (LGA) and the Resource Management Act 1991 (RMA), play a key role in flood management. Flooding is primarily managed at the regional level through Regional Plans. Thus, it is essential to evaluate the success of these plans in providing mechanisms for the management of flood occurrences, before, during and after events to understand the approach taken.

The purpose of this chapter is to develop and apply a framework with which to analyse both the Otago and Whanganui-Manawatu regions' flood policies. The aim is to examine how each of the two regions recognises and manage flood events within their current formal planning policy. The intention is to evaluate current policy and measure its effectiveness in regards to flood management. This policy data, combined with interview data, will be used to build a picture of current and future flood policy and the factors driving it.

Flooding is the most significant hazard that New Zealand faces; this will grow in the future as climate change fostered atmospheric changes contribute to greater flood intensity and frequency. The avoidance or mitigation of natural hazards, including flooding, are recognised as duties of local authorities in section 11a of the LGA. The RMA identifies the management of significant risks from natural hazards as a matter of national importance in section 6. Additionally, sections 31, 62 and 65 of the RMA, specify that regional plans must discuss the management of natural hazard risk and the risks associated with them and territorial authorities have responsibility for the avoidance and mitigation of natural hazards. This division is reflective of the shape of local government in New Zealand, where regional councils are responsible for environmental management, including that of rivers and lakes. District councils, on the other hand, are responsible for land use, including building consents. Consequently, district councils have input on ensuring that buildings are capable of withstanding events.

The method that was used to analyse both regional and district level documents is discussed below. The method needed to be able to accommodate different strategies and measure their effectiveness in detail which drove the design of the method employed in this chapter.

4.2 METHOD FOR PLAN ASSESSMENT

Regional Plans are an essential element in this research due to the duties of regional councils, as established by the RMA, LGA and Civil Defence Emergency Act 2002 (CDEA). These documents guide the approach a region takes towards flood management. Additionally, district planning documents may contain detailed information and focused consideration of the issues raised in the regional policy statement, particularly around land use and building resilience. Consequently, evaluation of district plans is needed. Another factor to consider is the difference between policy statements and regional plans. Policy statements provide overall direction in the form of objectives and policies at either the national or regional level, while a regional plan refers to operative plans approved by a regional council.

A crucial part of the analysis was first defining what could be considered to be indicators of issue recognition in the planning documents. The literature review indicated that there is a range of responses that used in the management of flood risk, split into four distinct groups, mitigation, adaptation, avoidance and social capacity building (King, 2008). Consequently, these four components form the basis for the assessment along with an additional component, preparation for changes in climate. Recognition and support provided by central Government, specifically the Ministry for the Environment (MfE), drove the decision to use these components.

The first component recognises that flooding is a natural event, and one with no solution. Mitigation seeks to assess how flood events are tempered, through hard engineering, land use planning or other mechanisms intended to reduce the impact of flooding. Additionally, economic factors must be considered, as mitigation reduces the costs of clean up and repair, while also at the same time, depending on the mechanisms used, could lead to higher costs in an attempt to secure vulnerable areas.

The second component, adaptation, is representative of the attitude that views flooding as an ongoing problem and one where the solution lies in recognising and adjusting to this fact. Thus, rather than investments in hard defences to halt flooding, the preferred approach is to either avoid or abandon these areas. In cases where development must continue, technology and methods such as floor level requirements can ensure that the people and resources are at

minimal risk. Regulations such as floor levels and storm water management are considered adaptation measures for this analysis.

Avoidance refers to measures that circumvent the risk of flooding entirely. Examples include limiting new developments in at-risk areas, and the gradual demolition and abandonment of high-risk areas as people leave and new development is halted. While this is likely to be the most successful measure in reducing the likelihood of human exposure to flooding, it is also the most difficult to achieve, due to personal attachments and factors such as the appeal of low housing and building prices.

The fourth component assessed here is Social Capacity Building. Social Capacity Building refers to the social connections and conventions of communities, including the length and depth of the social networks that have developed that in turn may influence their actions. The intention is to build resilience among communities and individuals. Key to this is fostering and developing a shared sense of belonging among people and places. However, this attitude may complicate situations where avoidance may be a more practical response than building resilience behaviours.

The final consideration is climate change. A significant body of work establishes that the predicted changes to the climate can, in turn, be expected to lead to an increase in the level of moisture in the atmosphere. Climate Change will lead to more flood events, either as a result of an increase in frequency or due to increases in the intensity of flooding. Thus, when preparing for future events, the existence of provisions or the recognition of the potential changes and hazards brought about by climate change should be recognised by authorities and present in the plan. While not the primary focus of this research, sea level rise (SLR), is of tertiary relevance and included as an aspect of climate change.

These components establish a baseline by which to judge a plan and how it recognises and prepares for future flood events. This baseline allowed a detailed analysis of the content of the major planning documents for the selected regions.

Each component was measured independently from the others. The components are broad in scope and encompass a range of responses and potential actions. Flood management incorporates all the components to a degree, making it difficult to score components in isolation, to address this, the analysis includes a combined score of the components.

Tables 1 to 5 below set out the key used to guide the analysis of the above components, using a graded scale ranging from 0 to 3. Where 0 is no recognition of the component, 1 is minor recognition, 2 moderate and 3 is representative of comprehensive recognition of the component in the planning documents. Components were found in several differing parts of the plan, ranging from: the introduction; key reasons for adoption; issues; objectives; policies and methods.

4.3 ISSUE COMPONENT KEYS

4.3.1 MITIGATION MEASURES

1		Damage Mitigation
	0	No mention of mitigation measures.
	1	Brief mention of mitigation measures.
	2	Some mention of measures as well as maintenance of existing measures.
	3	Explicit mention of mitigation as well as provisions relating to their maintenance or development.

Table 1: Scale of Mitigation measures.

The difference between a 2 and a 3 was considered to be the degree of recognition that physical protections such as stop banks receive. Due to mitigation dominating in the previous century, it makes more sense to differentiate the comprehensive plan from the acceptable plan by assessing the degree to which new mitigation measures can be developed and put into place. On the other hand, a plan that makes no mention of mitigation would rank 0, while some mention of mitigation, but no discussion of maintenance or development would result in a ranking of 1.

4.3.2 ADAPTATION MEASURES

2		Adaptation Measures
	0	No mention or discussion of adaptation in the relevant planning documents.
	1	Some mention of adaptation, but no clear timeline or recognition of methods
	2	Discussion of adaptation, but no clear timeline or if there is a timeline then no clear discussion of what methods are most relevant.
	3	Comprehensive analysis of adaptation including a clear structure for its adoption and a plan for its introduction and development.

Table 2: Scale of Adaptation measures.

Due to the previous dominance of hard engineering, adaptation has received less focus in previous research. However, new developments are expected to comply with a range of more stringent measures that are intended to minimise flood risk exposure. Here scores of 3 would represent situations where there is a clear path to adapt previously developed areas which are now recognised as being exposed, while 2 would mean that while adaptation is occurring in new developments, there is nothing aimed at old development. A score of 1 would require recognition that adaptation is desirable, but no effort made to ensure it occurs. While once again a score of 0 would indicate that adaptation is not in the document.

4.3.3 AVOIDANCE MEASURES

3	Avoidance Measures
0	No mention or discussion of flood avoidance measures
1	Recognition, but no mention of how to accomplish this
2	Recognition, as well as provisions to encourage the adoption of avoidance measures
3	Comprehensive plan detailing how avoidance measures will be introduced and used to limit the risk of exposure to flooding.

Table 3: Scale of Avoidance measures.

Avoidance is a preventive approach. Thus, it more than the other components is a sharp shift away from the reactive historical approach. The intention for assessment here it to determine the degree to which plans make accommodation for avoidance measures. Again a score of 0 means that there is no effort what so ever, a score of 1 indicates that avoidance is recognised, but there is no effort to develop the measure within the plan. A Score of 2 indicates that there has been some development, although it is not comprehensive, while a score of 3 indicates that the plan has a well-rounded and developed series of measures for promoting and developing avoidance in policy over the short to long-term.

4.3.4 SOCIAL CAPACITY BUILDING MEASURES

4	Social Capacity Building
0	No recognition of Social Capacity Building
1	Minor Recognition of Social Capacity Building
2	Recognition and some measure of policy towards Social Capacity Building
3	Well developed and comprehensive approach to Social Capacity Building

Table 4: Scale of social capacity building measures.

Social Capacity Building is another means of assessing flood resistance. Specifically, it refers to the resilience of communities and their ability to withstand and recover from flood events. The concept has received increasing attention from both academics such as Kilvington and Saunders (Kilvington and Saunders, 2015), and regional councils such as the Bay of Plenty. Again a simple scale has been used where 0 scores indicates that the documents have no recognition of the component while a 1 indicates some recognition of building community resilience. A score of 2 indicates some measure of policy is either present or stated as being developed. Finally, scoring a 3 would show a comprehensive approach to Social Capacity Building including a dedicated movement to educate the population about how to build resilience to hazards.

4.3.5 CLIMATE CHANGE MEASURES

5		Climate Change
	0	No recognition of Climate Change or the impact it could have in terms of flooding
	1	Climate Change is recognised as a potential hazard
	2	Climate change and its relation to flooding is recognised. Some ground work is placed for developing policy
	3	Comprehensive recognition of Climate Change and its potential effects as well as a policy and framework developed or in development to accommodate and deal with the potential changes and impacts.

Table 5: Scale of climate change measures.

Climate change is a growing concern that will have a severe impact on future flooding. To this end, any planning documents that deal with flooding and are forward-looking will need to accommodate and recognise this. Using this scale a score of 0 indicates that the document has no recognition of climate change. A score of 1 indicates that while it is recognised, there is no effort made to prepare for the changes it will bring to flood hazard management. A score of 2 shows that it is both recognised and there is some measure of effort to develop an approach that will minimise the disruption it brings. Scoring a 3, on the other hand, indicates a strong framework and body of policy in place with which to accommodate and deal with the subsequent effects of climate change.

4.4 COMPONENT RECOGNITION

The following table shows the results of the analysis. The combined total represents an aggregate of the scores each document receives across the five categories. This score allows for a comparison of plans in an overall approach to flood management as well as separate components.

4.4.1 COMPONENT RECOGNITION SCORES.

Plan	Component					Issue Recognition Total
	1	2	3	4	5	
Otago Regional Water Plan	2	2	3	2	1	10
Otago Regional Policy Statement	3	1	2	2	1	9
Dunedin City District Plan	3	1	2	1	1	8
Horizons Regional Council One Plan	3	2	3	2	2	12
Manawatu District Plan	2	3	3	1	0	9

Table 6: Scores of assessed plans in the five components.

While mitigation scored highly, in general, this trend did not hold true for other components. Documents across both regions scored poorly in climate change and social capacity building possibly as result of their relative newness as areas of concern and their nature as non-physical concepts which increases the difficulty in communicating the concepts behind them. Additionally, while the Horizons Regional Council has combined all of their documents into one, the One Plan, this is not the case with the Otago Regional Council. As a result, for Otago, an assessment of the Regional Policy Statement, containing the objectives and policies related to flood management, and the Regional Water Plan, containing the rules relating to these objectives, were conducted. The two documents combined guide flood management in Otago.

4.4.2 OTAGO REGIONAL POLICY STATEMENT

Chapter 11 of the Otago Regional Policy Statement (ORPS), is dedicated to natural hazards. This chapter acknowledges flooding as one of the major if not the primary hazard that faces Otago, yet, there is no explicit mention of policies wholly concerned with flooding and only flooding. However, the Otago Regional Water Plan does go into further detail about flood management specifically.

Chapter 11 of the Regional Policy Statement, discusses mitigation as an essential factor and it appears throughout the chapter, including a recognition of the Otago Regional Council (ORC) as having a duty to mitigate hazards on the regional scale. This recognition appears in the introduction (11.2.3), focusing on enabling community responses identifying ORC construction and management of river control schemes as one example. Further, issues 11.3.4 and 11.3.5

both concern themselves with mitigation, in old developments and new developments respectively. Objective 11.4.2 explicitly discusses mitigation measures while objective 11.4.4 promotes mitigation in the context of limiting the effects of hazards on natural and physical resources.

Regarding explicit policies, this is again strong with policies 11.5.2, 11.5.3, 11.5.4 and 11.5.7 all relating to mitigation, although only policies 11.5.2, 11.5.3 and 11.5.4 do so explicitly. Methods such as 11.6.2, 11.6.3, 11.6.4, 11.6.5, 11.6.6, 11.6.7 and 11.6.8 support these policies, covering a range of mitigation methods including hard defences, identification and natural restoration processes.

It is also important to note that issue 11.3.7 identifies that active defence measures, a significant aspect of mitigation, can have a negative impact on the environment. This observation fits into the broader debate around human interaction with the environment and shows recognition of the relationship between flood and environmental management.

The statement scored poorly in adaptation. This was due to the lack of discussion around the component, the word does not appear in the document at all. However, despite this, there are some policies and objectives that can be considered adaptation measures. The third goal of chapter 11, makes mention of enduring and resisting the effects of hazards which relate to adaptation. The desire to educate and gather information about what Otago residents consider tolerable risk and the limits that they are willing to live with is also evidence of adaptive measures. The discussion around the District authority and their use of tools such as zoning and development control can also be seen as a form of adaptation, even if not defined that way.

Regarding specific policies, both 11.5.4 which calls for building knowledge across Otago and the communities within it, as well as policy 11.5.6, which calls for establishing what the Otago community is willing to accept can be both seen as adaptation measures. Adaptation also fits into the broader context of the chapter which focuses on both consultations with the community and building knowledge as significant factors. One specific method of interest concerning adaptation is method 11.6.19 which calls for the promotion of codes of practice to relevant groups to assist in the management of Otago's natural hazards. While methods 11.6.20 can provide a means to district and city councils to provide means of adaptation to their ratepayers and are peripherally related to adaptation.

The third measure, Avoidance, is typically contained within the same sentence as mitigation. This combination includes the introduction which explicitly mentions avoidance as a movement away from exposed or at-risk areas. To a lesser degree, the recognition of the lack of knowledge about hazards within Otago can also be seen with avoidance, as improvements in this area would, in turn, result in a community and local government better equipped to put avoidance into practice. Related to this is the use, by district and city councils of land controls to deliberately prevent development in exposed or at-risk areas. Again, section 11.2.3 makes mention of avoidance in the same section as mitigation, implying that they are of equal value. The primary issue associated with avoidance is 11.3.5 which concerns itself with the need to incorporate the concept of avoidance into future developments. Again this issue makes specific mention of the issues around a lack of knowledge, calling for either more information in areas which are lacking or focusing development in areas where knowledge is available. More broadly, the recognition in issue 11.3.6 that human actions can, in turn, affect hazards, should also be recognised for the implications this has regarding avoidance.

Two objectives relate to avoidance, objective 11.4.2 which calls for the avoidance or mitigation of hazards, and 11.4.4 which calls for the avoidance of the impact of hazards on natural resources within Otago.

Several policies are of interest, including policy 11.5.2 which calls for taking necessary actions to avoid or mitigate hazards, while 11.5.3 looks at restricting development in at-risk sites where mitigation is insufficient. Policy 11.5.4 Plays a significant role in the broader topic of hazard avoidance in Otago, chiefly through building knowledge, and the promotion of means to avoid those risks and making use of natural processes to manage risk.

Concerning the discussed methods that can be attached to avoidance, 11.6.2 with its concerns around issue identification and building knowledge is a principal tertiary method, as well as 11.6.10 with the focus it has on regional cooperation, can also be seen as such. However, Avoidance is primarily present in methods 11.6.3, 11.6.4, 11.6.5, 11.6.9 which make direct mention of avoidance.

The concepts that encompass social capacity building can be present in the document. The introduction recognises the importance of communities, both in education and management and calls for communities to have the ability to endure, resist and possess the capacity to clean up and restore themselves, a clear link to the concept of Social Capacity Building. Feeding into

this is the broader discussion around what the community considers to be tolerable risk, the lack of understanding and knowledge that has already been raised also feeds into this dynamic. What this shows is that there is growing discussion around these concepts, although there is little evidence of a significant adoption of the component into regional planning documents.

Social Capacity concepts are present in issue 11.3.2 which recognises the need for an improvement in public awareness around the topic of hazards and risk, while issue 11.3.3 is also related to the component with its call to recognise and incorporate the level of risk that the public determines is acceptable. Objective 11.4.1 is relevant to the component due to its call to “recognise and understand” the hazards that threaten the communities of Otago. Issue 11.3.6 is also applicable as it recognises the effects that human use and actions can have on hazard vulnerability should also be noted here. Objective 11.4.3 is also directly linked to social capacity building with its call to effectively and efficiently respond to natural hazards occurring within Otago, and this is seen with the objective explicitly discussing the need to prepare for future events.

Regarding policy, mechanisms for Social Capacity Building are present in policies 11.5.4 with its goal of building knowledge, while policy 11.5.5 is explicitly related to social capacity building with its goal of establishing mechanisms for response recovery and restoration capacity. Additionally, policy 11.5.6 stresses the need to engage the broader Otago community in what they deem acceptable risk and what they are willing to accept, while policy 11.5.7 promotes the development of community-based responses within Otago. The methods reflect the policies within the statement, referring to knowledge building, flood warning capacities and community responses, all of which indicate that there is a firm basis, within the statement, to build social capacity about flood events.

Concerning climate change, there is recognition of a link between the changing climate and the risk this poses to low lying areas, both coastal and inland (Chapter 3.4), explicitly stating that increased rainfall can be expected to lead to an increase in flooding. In chapter 7 of the statement, issue 7.3.2 recognises that Climate Change may influence the future environment of the Otago region, it recognises that there is still confusion about what the effects of this will be, but due to the uncertainty, it is hard to predict.

Notably, this issue is present in chapter 7 (air), and links are present to several other issues and topics including, Manawhenua, Land, Coastal issues, the Built Environment, Biota, Energy and

Waste. There is no direct discussion of climate change in these chapters, nor is climate change raised concerning hazards, except for a brief mention in chapter 3.

Climate change does make an appearance in chapter 8, specifically in the context of sea level rise, with policy 8.5.8 which links sea level rise to climate change. While there is an external link to flooding, again this link to climate change is more peripheral than a direct link, and the connection lies more with the origin of the data (International Panel on Climate Change).

The Otago Regional Water statement is of some significance to flood management, however, with its overall focus on river and lake bed management, it is of limited relevance in this context. Of interest are the additional rules and conditions around flood management, especially concerning managing river and lake beds. However, despite this, the document does not radically differ from the policies and rules advanced by the Regional Statement. Some areas of interest include recognition that land reclamation often leads to further exposure to hazards and should be avoided where possible, (policy 8.8.1). The document also states that in cases where development, either deposition, reclamation or hazard protection works occur will only go ahead when they are necessary (Anticipated environmental result 8.9.9).

4.4.3 DUNEDIN CITY PLAN

The Dunedin City Plan (DCP) scored a total of 9. Much like the regional policy statement, there was a chapter concerning itself with hazards. Unlike the Otago Regional Policy Statement, however, the chapter included hazardous substances and earthworks as a part of the chapter rather than looking at hazards separately from other topics. Notably, the introduction discusses Sea Level Rise as a primary concern.

Mitigation, in particular, was a significant feature of the document and well developed in policy and implementation. Recognition of areas in need of mitigation appears in the introduction as well as an acknowledgement by the DCC of the need for mitigation measures. The document also recognises that SLR will require mitigation works in the future. Issue 17.1.1, the recognition that Dunedin is susceptible to hazards, including flooding, is useful as it forms a basis on which the assessed criteria can then be built on and further developed. Of specific relevance when considering mitigation, issue 17.1.3 recognises that past development has occurred in exposed areas. Issue 17.1.5 is also of interest concerning mitigation, with its recognition of the importance of management regarding mitigation measures. While not the primary focus, there is also recognition in issue 17.1.7 that earthworks could negatively influence flood susceptibility,

reflecting a broader theme around the modification of the environment and its impact on hazard vulnerability.

Mitigation again appears in several the objectives of chapter 17, namely 17.2.1, which calls for the “avoidance, remedy or mitigation” of both natural and technological hazards. The objective recognises both planning and structural engineering options in response to these objectives, both of which constitute mitigation measures. As with issue 17.1.17, objective 17.2.3 recognises the effect that earthworks can have on hazards and the potentially adverse contribution it can have towards hazard vulnerability. Storm water provisions further support these measures through ensuring effective management of storm water within city zones.

Several policies link directly to mitigation measures in Dunedin. Policy 17.3.1, for example, which calls for the gathering and maintenance of information into and about hazards, is of direct relevance to mitigation, allowing mitigation measures to develop in areas where they are most needed. Linked to this is policy 17.3.3, which allows for building controls to be used in areas where the risk of flooding is high, making specific mention of protective works and mitigation.

Regarding the methods available, 17.4.1 (Hazards register), 17.4.3 (Land and Project Information Memoranda), 17.4.5 (Liaison), 17.4.9 (works programmes), and 17.4.11 (Zoning) are all relevant to flood mitigation. Methods 17.4.1, 17.4.3, 17.4.9 and 17.4.11 are all indications of a robust mitigation approach, focusing on building knowledge and using that knowledge to provide structural defences in required areas, or through regulatory methods such as zoning to limit exposure and minimise the demand and use of hard mitigation measures such as stop banks.

For adaptation, the plan had a score of 2. This score is reflective of the absence of adaptation from chapter 17. Despite this, aspects of adaptive measures are present. The recognition that future events, such as sea level rise, will require measures to be taken, can be seen as evidence of a degree of adaptation awareness. Issue 17.1.1 again serves as a useful measure for this component, demonstrating a recognition of the relative vulnerability of Dunedin to hazard events, and flooding in particular, while issue 17.1.4 also serves a role in recognising the need for more information to ensure the success of future adaptation measures. However, it is issue 17.1.3 that is the most important regarding adaptation, recognising that development has occurred in high-risk areas where hazards have or have the potential to affect people and

possessions negatively. This issue allows for the development of policies which explicitly aim to adapt these developments to accommodate these hazards.

While it can be argued adaptation is present in objective 17.2.1, in reality, none of the objectives explicitly refer to adaptation in response to hazards. The policies also fail to refer to adaptation. While the policies provide a basis to build adaptation strategies, as can be seen with policy 17.3.1, none provide recognition or a path forward for adapting to flood-prone areas. However, policies 17.3.3, 17.3.4 and 17.3.5 can arguably be considered adaptive measures, with their aim in limiting development in areas which are likely to see an increase in exposure to flooding, although they can also be linked to avoidance.

The above applies to the methods discussed in chapter 17 as well. Arguably the promotion of knowledge can be viewed as a part of adaptation, yet the lack of explicit adaptation strategies, means that the plan cannot be considered to have a comprehensive adaptive policy. When considering floor levels, there has been more effort put forward in recent years. Documents such as *"A Methodology for Determining Minimum Floor Levels"* (2011) show that adaptation measures are increasingly being recognised, at least with regards to new developments. Additionally, the Three Waters Strategy is responsible for the management of storm water in Dunedin, limiting the relevance of adaptation to the Dunedin City Plan.

The third component, avoidance, is more strongly recognised in the document. Issue 17.1.1 once again serves as a blanket recognition of the hazard risk to Dunedin, as does 17.1.4. Of interest concerning avoidance is the recognition in issue 17.1.5 that the effects of hazards require effective management. This indicates a level of recognition of avoidance as a viable strategy in regards to dealing with natural hazards in Dunedin.

The above is also seen in objective 17.2.1 which again recognises avoidance as a viable method of managing hazards, and makes specific mention of using building control as a mechanism of avoidance. Further support for this approach is policy 17.3.1, which again provides a knowledge base of hazards to use as a means of making informed decisions while policies 17.3.3 through to 17.3.6 provide for control of development in areas which are likely to be subject to flood hazards, including sea level rise. The above, when considered alongside methods such as the hazards register, the land and project memoranda, management plans and zoning can all provide robust mechanisms for avoidance. Due to the close links made between both avoidance

and mitigation, it makes sense to view the approach taken by the DCC as one where the two are interchangeable.

Several methods relate to avoidance. Once again those connected to mitigation make for a valid comparison. However, regarding the mechanisms that best facilitate avoidance, 17.4.8 (information, education and public awareness) and 17.4.11 (Zoning) promote avoidance of flood hazards for future development. However, due to the lack of provisions or allowance for the managed retreat of people in areas that are too exposed or those predicted to become so in the future, it cannot be considered a 3.

Social Capacity Building Capacity has a small presence within the document. The issues while recognising the risk that natural hazards pose to residents, fail to mention building stronger, more prepared communities. This lack of presence applies to both the stated objectives and policies.

Issue 17.1.5 does recognise that effective management in regards to hazards is needed to ensure the safety and health of the community. Issue 17.3.1 also recognises the need for the community to be aware of hazards and the associated risks. While not mentioning stronger communities, the policy does recognise the importance in making the community aware of the broader issues associated with flooding.

Several methods promote some manner of social capacity building. Of these, education is the one most directly relevant. Aided by methods such as the hazards register (17.4.1), Land and Project information Memoranda (17.4.3), as well as 17.4.8 (information, education and public awareness). These methods provide mechanisms for informing communities about events and how to respond to them. Method 17.4.5 is also relevant, considering the role that the Ministry of Civil Defence has in hazard management.

Despite the above, there is no substantive discussion around building stronger or more resilient communities within the chapter. Consequently, the document is not strong in this component.

Regarding the fifth component, Climate Change, the plan again scored poorly. This was driven by the failure of Climate Change to appear in the chapter. While there is reference made to the relationship between global warming and sea level rise in policy 17.3.5, it does not go into detail, observing that it is difficult to make predictions on sea level rise, due to the difficulty in

predicting future climate. The policy calls for controlling development in areas that are likely to be exposed to rising sea levels. However, this is itself questionable due to the uncertainty around what these future levels are likely to be. Methods such as 17.3.1, 17.4.3 and 17.3.9 are the most likely processes that will positively contribute to managing this component, although again there is a strong lack of dedicated direction while the provisions only apply in a more general sense.

4.4.4 OTAGO REGION SYNTHESIS

Mitigation and avoidance both figure prominently in the documents and accordingly, scored highly. Adaptation scored poorly, with little presence in the documents or any indication that there would be an increased focus on adapting to future and current flooding. Both Social Capacity Building and Climate Change also scored poorly. One possible explanation for this is the age of the documents. Both plans were published nearly twenty years ago. As a result, the information that was available at the time is limited, and an attitude that still prioritised mitigation and viewed flooding in an adversarial manner was dominant. With both documents currently undergoing reviews, there is a strong likelihood that their scores will change significantly, as a result of new ideas and changes in direction. However, a pivotal aspect to flooding in Otago is the fact that a major urban centre, Dunedin, is highly susceptible, particularly in the southern areas, which houses more vulnerable people than other parts of the city. This distribution adds to the challenges around flooding and has significant implications for discussions around avoidance and mitigation in the future.

4.4.5 HORIZONS ONE PLAN

The Horizons One Plan (HOP) scored consistently across all metrics and achieved the highest score out of the assessed documents. Interestingly, the plan recognises the broader context around flooding number of processes and in the introduction ties flooding to several chapters (3, 4, 5 and 9). Additionally, it recognises the link between the topography and history of the Manawatu to the current issues facing flood management in the area. This interconnectedness is observable with the linkage of unsustainable land use compromising existing flood protection schemes in the region. More importantly, the document makes explicit mention of both hard and soft defence measures, indicating a developed understanding of flood management practices.

The document scored highly in mitigation measures. The reasoning for this was due to the varied and comprehensive approach taken in response to flood mitigation. This approach can

is present in chapter 5, which recognises as objective 5.4 the need to manage river and lake beds for flood mitigation purposes (5.4(d)). Policy 5.22(b) reinforces this approach through aiming to prevent the placing of artificial limits on the ability of rivers to carry flood flows.

Within chapter 9, the dedicated chapter on flood hazards, there is recognition that land disturbance and clearing of vegetation can have a negative impact on the effectiveness of mitigation measures. When considering policy, mitigation is strong, policy 9.1 sets out the responsibilities of the regional and local authorities, with the regional council taking charge of setting a framework for natural hazard management. Policy 9.2 requiring development in areas prone to flooding are designed to resist a 1 in 200-year flood. The policy also requires these new developments to avoid compromising existing defensive structures. There are also considerations of the potential effects should the defences fail, as well as ensuring clarity about ownership and maintenance schedules. Interestingly, the document states that the 1 in 200-year level is an increase from previous requirements which only required 1 in 100-year protections. The policy also states that development cannot negatively impact on the effectiveness of the current flood protection measures. Policy 5.24 enforces mitigation through the requirement that flood protection levels are maintained or enhanced from the level they were at in 2007.

The document uses several methods to aid in the implementation of these policies. Method 9.2 promotes research into what areas of the region are prone to flooding, allowing for informed decisions. Method 9.6 is also of interest, as it directly ties increasing public knowledge and information in the public sphere with mitigation measures.

Several methods used by the One Plan incorporate adaptation. This link occurs through the development of knowledge that these methods provide, rather than any directive to ensure that existing dwellings are pushed to ensure that they are not at risk of exposure through flood proofing or raising their floor heights. These measures are not a duty of regional councils, and thus, the omission of these measures in the One Plan is logical.

There is no specific mention of adaptation in the document. There is evidence of adaptation policies within it. Evidence of this lies in the increase in standards from the previous requirement that protection works withstand a 1 in 100-year flood to the current requirement that all defensive works and new developments are capable of withstanding a 1 in 200-year flood.

Avoidance was also encouraged in the one plan, with Objective 9.1 calling for hazard avoidance or mitigation. Development, either new or expansion of old buildings, under policy 9.2, is prevented in areas zoned as flood ways''. Outside of these areas, unless meeting the mitigation methods discussed above, development is prohibited. Part C of policy 9.2, which states that avoidance must come before mitigation measures, adds further support to an avoidance based stance. The policy also requires that new infrastructure not compromise the integrity or effectiveness of avoidance measures. As a result, there is a clear and comprehensive policy which prioritises avoidance while allowing mitigation in situations where avoidance is not possible. Policy 9.3 uses avoidance to prevent the development of critical infrastructure in areas likely to be affected by 1 in 200-year floods, except in cases where flooding will not affect the development, or because there are no alternative locations.

Once again methods 9.1, 9.2, and 9.3 are the most likely to be of relevance to this component, as the development of knowledge and mapping of at-risk areas contribute to identifying areas to be avoided and allowing for informed decisions. Also of importance is ensuring that the public is aware and informed, which promoted through method 9.4.

Social Capacity Building is another component that does have a significant presence in the document. There is a recognition that people living in the area are at risk, and that with more people moving to areas at risk of flooding, including coastal and riverside towns, mitigation measures such as stop banks are placed under additional stress as the population in these areas increases. The document identifies a connection between erosion in the upstream areas as a result of human activity and flooding too. This link is made in issue 9.1, while objective 9.1 recognises the need to prevent the adverse effects of these events from impacting on the community.

Despite this, there are no policies that attempt to build stronger communities or encourage resilient behaviour in residents in response to flooding. The approach taken by the document places much greater focus on encouraging avoidance and mitigation in places where this is not possible. With this said, the methods promoted by the document and their focus on gathering knowledge can be seen to be peripherally related to building stronger communities, by allowing residents to recognise at-risk areas and in turn make an informed decision about where and how they live.

The introduction recognises that while Climate Change is not considered one of the four main issues facing the region it is an overarching issue, touching on several critical issues. Additionally, there is recognition that the changing climate has the potential to contribute to increased rainfall and larger and more frequent flooding. Importantly, the document recognises in the proposed approach the need to consider these changes.

The document recognises that there is a lack of information available on the effects of climate change. Accordingly, it takes a precautionary approach in regards to land use has been adopted, calling for further research while contingency planning is expected to deal with the effects.

Issue 9.1 recognises that climate change is likely to contribute to a more extreme hydrological cycle resulting in more frequent hazards, flooding among them. It also recognises that coastal flooding is likely to increase as a result of sea level rise. While the objective does not directly refer to Climate Change, policy 9.5 makes explicit reference to it. The policy calls for a precautionary approach, when assessing the scale and frequency of events, particularly when it comes to mitigation and avoidance mitigation strategies.

The methods promoted by the One Plan provide a strong basis on which to build a response to climate change. With a focus on gathering accurate data and using that data to then inform residents of the region about the dangers and risks that they face, it represents a significant departure from the other documents. Due to the uncertainty around climate change and what its effects will be, policy, at this stage, is focused on gathering knowledge. A secondary aim is to make this information available and focus on measures that allow for some degree of preparation for a future climate whose exact nature is uncertain.

4.4.6 MANAWATU DISTRICT PLAN

The document states that flooding is a significant hazard facing the district and the region. Flooding, as well as other hazards, are noted as placing limits on growth within the district. The plan scored reasonably highly in most components, especially in avoidance and adaptation measures. However, in other areas, major gaps were identified.

Mitigation measures scored reasonably high in the plan. The plan identifies mitigation as the first and more direct method to reduce exposure to hazards. However, due to the division of duties between the Regional and District councils, mitigation in the Manawatu District Plan relies on land and building control to mitigate flood hazards. Several policies can link to

mitigation measures. While lacking in specifics, policy D, which aims to reduce the severity of flooding and land erosion events, provides a mechanism that can be used to guide the approach to mitigation in the Manawatu. Additionally, policy H provides a mechanism with which to ensure that at least one building site is not prone to natural hazards. The plan also makes mention of using s36 of the Building Act 2004 to refuse a consent application which would make an existing hazard issue worse. There is also provision within the plan for in some circumstances, removing or stop banking dwellings located in flood-prone areas.

Adaptation measures feature prominently in the document. Policies such as 8.f state that all buildings potentially affected by 100-year flood events do not divert or impede the flow of water significantly, evidence of adaptive measures based on location. Policy 8.g also supports adaptive measures through requirements that dwellings that are potentially affected by 100-year events are designed to prevent waters entering the building. The third goal of the MDC also supports adaptation through the promotion of the sustainable use of hazard-prone areas. The identification of flood-prone areas such as Flood Channel Zone 2 also indicate adaptation as while development is allowed within this area, there are minimum standards such as floor heights must be met first.

Enforcement of the above occurs through several methods, notably the Building Act 2004 and the controls around it, as well as the storm water control regulations for new buildings in areas where storm water runoff causes or aggravates flooding issues. Of further relevance here is the provision allowing for council protection of buildings identified as heritage, which potentially allows for flood proofing in some cases. Section 8.3 (anticipated environmental results), makes it clear that the goal of the adaptation principles within the plan, aim to minimise the human impact on flood flows and thus, their potential to have a larger impact than they might otherwise have. Additionally, under other methods, there is explicit mention of storm water control in new developments where runoff causes or aggravates flooding problems.

The plan also scored highly in avoidance. While not explicitly stating that avoidance is the first preference for development in the Manawatu district, several provisions facilitate avoidance. Keeping people away from hazards is listed as the second preferred method for reducing event severity. Support for this approach is objective NH2, which aims to avoid development which would adversely affect residents' health and safety.

Policy 8.e reinforces the above. The policy prevents the construction of dwellings in areas subject to deep or fast flowing floodwaters this then provides a basis on which the council can build, by providing a mechanism for recognising land where development would place too many people at risk, and thus undermine objective NH2. Of interest about avoidance is the area classed as Flood Channel Zone 1. These, comprising of three areas, where flood flow velocities or depth of water, have resulted in development being considered non-complying. Outside of this, the plan also states that when considering new council developments, natural hazards are taken into account. This has the result of preventing development occurring in areas that are subject to significant flooding, and thus serve as a good example of avoidance.

Social capacity building is also present, although not to the same extent as other components. Policy 8.a serves as the most fundamental of these, recognising the need to further build and develop the knowledge base about the natural hazards and risks that the district faces. The document recognises that this is a duty of the regional authorities, although it also states that the MDC has a duty to work with the region to gather hazard information, explicitly referring to situations where local detail is needed. The plan refers to the council providing landowners and interested parties with relevant LIM and other data, as well as promoting information and education opportunities around land use, particularly unstable land. However, this is a regional rather than district initiative.

Despite the above, the document makes no reference to stronger or more resilient communities in its anticipated environmental results. Additionally, there is no mention of using the information gathered to promote community initiatives or action, all of which would form a foundation for Social Capacity Building. Thus, while there are mechanisms related to the component present, there is insufficient policy or recognition of social capacity building to consider it a major part of the document.

The fifth component, climate change, also scored poorly. This score reflects the lack of any mention of climate change, or global warming in the document. Thus, there is no discussion or provisioning regarding responding to the changing climate and the impact that it may have on natural hazards and their impact on the district. The exception to this is in regards to sea level rise, identified as a potential threat to coastal communities within the district. Little focus is given to these communities, aside from a stated desire to limit development in these areas to minimise the number of residents exposed to rising sea levels. This control takes the form of limits on subdivision within these communities. Interestingly there is no mention of the risk of

increased, either intensity or frequency, flooding as a result of these higher sea levels in the coastal areas. As a result of the above, the plan scores a 0 in component recognition for climate change.

4.4.7 MANAWATU REGION SYNTHESIS

Mitigation measures scored well which is likely a result of the long history that mitigation has as a way of reducing the impact of flooding. Avoidance also scored highly mirroring the approach taken by Otago and indicating that mitigation and avoidance are the two components which are currently the most recognised. With that said, recognition of avoidance does not mean that discussions are developing around abandoning existing settlements which is the next logical step in developing an avoidance policy. However, the topography of the Manawatu makes such discussions challenging to make into reality due to the size and spread of floodplains in the region. Adaptation received significant focus, with the Manawatu district plan containing a significant amount of detail around developing adaptation mechanisms, which was mirrored, to a lesser degree, by the One Plan. Social Capacity building and Climate change again scored poorly in the Manawatu District Plan, with the failure to discuss climate change. However, the One Plan did discuss both components, recognising climate change as a growing concern for the future and recognising the importance of community resilience in withstanding flooding. Again, the age of the documents likely plays a role here, with the more recent One Plan incorporating more recent ideas and concepts, such as Social Capacity Building into it than the older Manawatu District Plan.

4.5 OVERVIEW OF DOCUMENT ASSESSMENT.

When considered alongside each other, the documents scored similarly. The Horizons One Plan scored the highest with a score of 12 and the Dunedin City Plan the lowest, at 8. When comparing components, more significant differences emerge. Mitigation measures were mostly uniform, with all four plans considered to have satisfactory levels of mitigation measures within them. On the other hand, adaptation scored much lower than mitigation across the board and often received little focus, with most measures classed adaptation as a peripheral factor to flood management rather than a technique in its own right. In comparison avoidance, shared many similarities to mitigation, typically considered in the same policies, with one or the other seemingly used interchangeably. As a result of the individual component scores broadly mirrored the mitigation score.

The final two components, both scored poorly across all documents. There was little mention of building stronger communities in the documents. Social Capacity Building came from the provisions on informing the public about the data and information available, and there was no mention of dedicated programmes to equipping communities with the tools to make decisions about how to protect themselves from flood risk. This tendency indicates that while there are aspects related to the component which can be built on, there is little evidence of 'true' Social Capacity Building. The age of the documents explains this, with Social Capacity Building only entering New Zealand discourse within the last three to four years. While the approach of the councils appears to be passive in regards to communicating knowledge around flooding, a more active approach would potentially lead to stronger communities and responses in the wake and during flooding.

A similar situation occurred with climate change, which while recognised in all of the plans aside from the Manawatu District Plan, did not receive any consideration beyond the need to gather more information about it. With this said, the relationship between climate change and increased flood risk was recognised, although only the One Plan did this on what could be considered a comprehensive scale. Thus, Climate change was another component which saw low scores across the board. This approach will change over time, as evidence and models become more accurate in their predictions and become more accurate. However, as it stands, there is arguably little benefit in planning for future flooding when the effects and scale of the events are so hard to determine. Over the next ten years, this approach will need to shift towards a more active one, as the climate changes. However, as it stands, there appears to be little, at this stage, to be done, aside from identifying areas of high risk and beginning discussions around abandonment and avoiding development in and around them.

It is worth noting that the One Plan is the most recent document (2012), with the others all first generation plans which are currently undergoing review. The Otago Regional Policy Statement was written in 1998, the Dunedin City plan in 2006 and the Manawatu District Plan in 2002. Thus, the low scores are likely to be reflective of a situation where data and information were limited, and the tendency to focus on data accumulation and mitigation measures were the most likely and constant ways to achieve the goals of the documents and councils. It is then possible that the relative absence of components 4 and 5 has more to do with the lack of information or knowledge around the components at the time of their publication than an active decision to ignore them. A similar argument can be made for the high degree of focus on mitigation, as this could be the result of the previous dominance of hard engineering in the past.

Related to this, the Ministry for the Environment only began to focus on these components as good practice after 2004.

Analysis of the plans has provided an overview of flood management and flood hazard planning as it currently stands. It also provides a snapshot of what are considered critical issues and what avenues future development in policy might take. Comparisons between two regions allow for an overview of what components can be considered strengths and what are weaknesses when compared to other parts of New Zealand. This analysis also has the benefit of allowing an overview of the success of the different management components and complications in the form of climate change regarding their presence in regional documents.

5 ATTITUDES AND OPINIONS OF INVOLVED PARTIES

5.1 INTRODUCTION

To understand how policy, attitudes and behaviours around flooding and its management influence the selected regions, it is necessary to investigate and speak to parties involved. These conversations facilitated a better understanding of the factors that influence flood management and are used to inform discussion around current and future policy. This chapter explores the attitudes of individuals involved in flood management in the selected regions. Based on interviews, held with identified key informants, finding four major themes. These are Policy and legislation, Communication, Resources and Environmental Knowledge. The chapter addresses these themes and how they relate to flood management in the Manawatu and Otago regions.

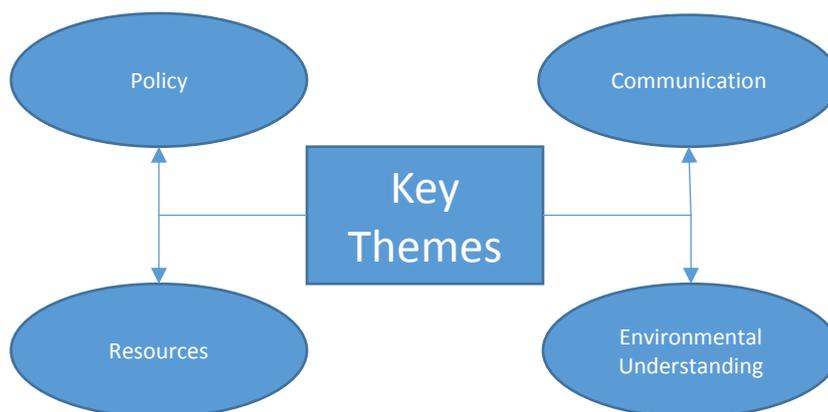


Figure 6: Key themes identified by Informants.

5.2 POLICY AND LEGISLATION

Sub-Topics	Current Policy
	Future Policy
	Central Government and its role
	Policy and Legislation Challenges

Policy is a broad topic concerning flood management. Four sub-themes relating to policy provide detailed analysis. The section provides an overview of the current and future position

of policy in the two regions. As outlined below the themes were defined as current policy, future policy, central government, and policy issues.

5.2.1 CURRENT POLICY

Key Informant 11	“The policy is aimed at protecting people and communities for the risk and devastation of floods.”
Key Informant 5	“Keeping people away from water and water away from people.”
Key Informant 16	“What we do is manage the risk, seeing where protection can be applied and designing along those limits.”

Table 7: Selected quotations relating to policy and legislation.

Overall the view of interviewees across both regions was mostly the same regarding current policy. Evidenced by statements made by Key Informant 11 (KI11), “The policy is aimed at protecting people and communities from the risk and devastation of floods.” While Key Informant 5 (KI5) made a similar statement in regards to flood management in Otago, “Keeping people away from water and water away from people.”

This emphasis is likely a result of the RMA driving flood policy, creating a degree of similarity that between the regions. A significant avenue of discussion was how effective these policies have been, with both informants above holding the opinion that these approaches had met the goals they set out to achieve. This view was mirrored in the private sector, evidenced by the stances of Key Informants 1 and 4 (KI1, KI4) who recognised that policy was a “living project”, and that changes had and would continue to happen regarding the approach to flood management and how people interacted with it. Key Informant 2 (KI2) was also generally positive in their views on current policy in the two regions. They did note, however, a lack of uniformity between different authorities and their approach to flooding across New Zealand, leading to issues when operating on a national scale. This stance is shown by their comment, “Working in insurance, you work with the whole country, and every district operates differently and collects different data... some councils work on frequency some don’t, and some don’t even have data,”.

The above statement by KI2, when combined with the comments by KI5 and KI11 about the policy direction of Otago and the Manawatu suggests that the level at which policy in Otago

and the Manawatu currently sits is effective at supporting the insurance industry when compared to other regions. KI2 further supports this view, saying, “Dunedin is very good, so is the Manawatu, the tools are the same we use, but if those tools are not there, then we cannot do anything about it, and people are left without being able to make an informed decision”.

The exception to these positive views came from Key Informant 8 (KI8), who felt that the current policy was “overcautious”. The informant went on to say that they felt that over time, this would fall away and into what they believed was a more measured approach rather than one which was “panicking over the thing,” in their view. KI8 then said that they felt the current approach was a step too far and that a “More practical approach would have been as good as what we got”. They went on to state that such an approach would have put a greater focus on smaller achievable goals rather than a bold approach which required significant buy-in from stakeholders that the council had no control over. They specifically mentioned soil erosion and the Horizons Regional Council SLUI (Sustainable Land Use Initiative) program as an example of this.

The public was mostly supportive of flood measures, KI5 noted this as well as Key Informant 16 (KI16), who stated past flooding had done brought the danger of flooding to the public conscious and kept it there. Key Informant 15 (KI15) exemplified this view when they observed that Horizons Regional Council was, “Doing the best they can, considering the landscape.”

Both KI7 and KI6 echoed KI15 in supporting the local government and their efforts suggesting that other factors limited the success that the councils could expect, their relative newness and the opposition of various groups within the region were two examples given. Both farmers in the hill country, who are opposed to restrictions on what land they can put into production and environmental groups, including Fish and Game faced accusations of pursuing agendas which did not take into account the entire region and the environmental issues facing it. These issues further complicated programs such as SLUI which are intended to provide holistic solutions to environmental issues in the Manawatu.

Based on the above, there is a clear indication of contentment with the current state of policy, particularly when compared to the past, a view consistent across both the Manawatu and Otago.

5.2.2 Future Policy

When asked about the shape that future policy would take, there was a consensus that risk management would continue to grow. KI16 made the point that evaluating and managing risk is what planners and engineers have looked at “right from the get-go”. Thus rather than a radical new approach, it makes more sense to look at risk management as a continuous and gradual progression. KI4 supported this view, saying that such an attitude was present even when they were at university thirty years ago. They then went on to state that the only change is the level of attention risk management is receiving compared to the past.

While KI4 felt it was an appropriate approach for the future, they felt people also needed to remember, “We are stuck with the development we have to an extent, there are options, but we need to accept that the previous approach has left us with some stuff there is no getting away from.”

KI16 echoed this view as outlined below.

There are many areas which are at risk now, but were settled because they were close to the coast or provided access to the interior, and I mean that is true for a lot of New Zealand cities. So going forwards, we have a lot of historical risk, which can be lowered to an extent, but once those limits are breached, it is dependent on the response. –KI16

A major focus of the authorities and reinforced by interviewed professionals was the need to focus on information. Both Key Informant 9 (KI9) and KI16 were strong supporters of this both discussing the need to update hazard maps and the use of LIDAR to build better pictures of current processes to inform the future approach. There was a growing focus on storm water and floor levels, identified by KI16, KI9, KI1 and KI8, showing support for a more regulatory approach. The thoughts of KI5 echoed this, “Legislative wise, we are lacking teeth a bit under the RMA, if natural hazard provisions were strengthened, I mean I am not sure the current stuff goes far enough, so strengthening them would be a good path forward in my view.” This statement indicates that there is a view among both professionals and local authorities that by allowing mechanisms for prosecution and enforcement, flood policy may see significant development with the promotion of consequences for failing to take adequate measures to limit flood effects.

A point raised throughout the research was the long-term unsustainability of relying on stop banks and mitigation measures due to sediment deposition in river beds. Identified as a significant factor in the Manawatu, where the stop bank debate was closely related to issues around silt in river beds.

The comment, “You’d hardly have to be Christ to walk across the river when it is in flood” from KI15 reflected the attitude held by the majority of the informants in the Manawatu. Intensive farming on the hill slopes and the resulting soil erosion is felt to be the cause. Some informants supported dredging waterways to lower river heights and reduce the need for higher stop banks (KI6, 7, 14, 15). On the other hand, Key Informants 10, 11 and 12 (KI10, KI11, KI12) thought that dredging was a temporary solution that failed to address soil erosion in the Manawatu, the underlying cause. While informants were clear that efforts were being made to address the issue, KI13 cited a lack of willingness among farmers, to adopt more sustainable practices as a core issue. Failure to adopt sustainable practices meant less precipitation fell before flooding occurred. Consequently, reducing the effectiveness of mitigation measures.

5.2.3 CENTRAL GOVERNMENT AND ITS ROLE

The national government has had a long history of involvement in hazard management in the regions. Over the last decade discussion has centred on the level of involvement that the central government should have. Suggestions of developing a National Policy Statement around flooding have been a key feature of this discussion. Therefore opinions and stances in regards to central government involvement are a central aspect of any discussion around flood management.

A major point raised by KI2 was the lack of consistency across the country, in terms of how floods are managed. This feeds into a wider discussion around the level of central government involvement which was raised throughout the course of the research.

While many key informants were supportive of government intervention, a number of concerns were raised as well. KI1 noted, currently (specifically referring to issues in South Dunedin), that New Zealanders were being put in a “Trying situation as a result of the environment and I think that there is an obligation to provide some level of aid.” This argument raises questions around personal responsibility and liability and there is a discussion around whether authorities or individuals should take responsibility for the effects of the natural environment on people. This

discussion is further complicated by the emotional nature of the consequences of natural events. KI11 articulated their concerns in their interview.

It was noted by several informants, particularly KI4 and KI14 that in the past there had been substantial government support for mitigation measures which as noted by KI16, KI14 and KI11, meant that a number of significant works were built and developed that in all likelihood would never even be possible today.

The above naturally lends support to the argument for a National Policy Statement (NPS) on flooding. With KI10 noting that had that been developed, it would provide the territorial authorities with some level of guidance and give them something to turn to in court cases. The informant noted a case in Dunedin where an initially denied consent was granted by the Environment Court. The Informant raised concerns about what that meant for regional councils and the promotion of avoidance. KI9 added to that, saying that there were already additional cases, with similar issues arising throughout New Zealand.

Despite this, there were a number of concerns with greater government involvement. KI7 questioned what that would mean for the districts and KI14 specifically noted that they did not believe that such intervention would have a positive effect on local democracy. KI16 went further, noting that Natural Hazards had been added to the RMA, which provided something approaching the same overriding purpose and that “Blanket limits on standards it would be blunt, additionally you would need to leave room for local authorities to manoeuvre considering the differences around the country, and then you also need to account for local plans and planning frameworks.

Consequently, while there is clear and strong support for some level of government intervention, there were major questions raised around the level of involvement. Also of note was KI9’s comment that if there was a NPS published in the next few years the issue it would run into was that,

The regional documents are either complete or quite far through and if there was a conflict between them then there are some pretty far reaching consequences which would come about as a result. But you can’t say what those will be until you see what they’re thinking it would look like. - KI16

The risk here is that a NPS would require significant alterations to regional planning documents. The result of this would be the need to spend significantly to bring regional and district documents into compliance, which would consume both time and funding which could be better spent on other issues affecting the regions. This is particularly significant considering the lack of monetary resources facing many of the regions.

5.2.4 POLICY AND LEGISLATION CHALLENGES

Policy is a complex and multi-disciplinary topic, requiring input from many individuals and organisations, this is all the more true for flood policy which is not readily clarified. Due to the involvement of many different parties, often with differing and at times, conflicting goals and views, there are several conflicts around and with policy. Additionally, legislation around flooding is a combination of old acts and new acts which cover a range of topics, further adding to the confusion. Those interviewed highlighted several of these conflicts, discussed in this section.

Informants raised further issues around the current policy. While most felt that the current documents were adequate, they recognised that they were limited by what knowledge was available about flooding. KI1, for example, noted that they rarely had to deal with anything beyond the Dunedin City District Plan and could not comment on anything beyond that.

Both KI9 and KI16 identified some significant issues around the Building Act, particularly sections 71 to 73 and their interpretation. KI9 stated that not only did understanding differ between councils on what those sections meant and how to enforce them, but building inspectors themselves differed in how they understood and applied them. When asked about this, KI16 echoed KI9 and added that it was an issue which would hopefully be solved when more and better data sets became available.

A second issue was the requirement in the Building Code for floor heights to withstand a one in a fifty-year flood. KI1 and KI4 both felt raising this level of protection was necessary, although they noted that district plans typically had higher requirements already. A point of comparison is the one in fifty-year requirement in the Building Code and the one in five hundred year defences in place in Palmerston North or even the comments made by KI9 who stated that at times they felt one in one hundred level protections were insufficient to protect Fielding.

When discussing legislation and if there was a need to look at updating it for new, modern conditions, the response was lukewarm. KI16 felt that there was nothing to gain from such an approach, while KI12 felt that a “Fresh look taking into account the modern setting and factors at play would be a good thing”. Echoing this, KI13 was unenthusiastic about the RMA, suggesting it needed to be overhauled entirely, noting that many of the problems associated with it had more to do with Parliament failing to provide enough commentary around the RMA at publication. KI5 also questioned the interaction between new pieces of legislation particularly around housing and how little weight they seem to place on hazard management.

5.2.5 SUMMARY OF KEY INFORMANTS IDENTIFICATION OF SUB-THEMES

Theme	Key Informants
Current Policy	KI1, KI2, KI4, KI5, KI8, KI9, KI10, KI11, KI16.
Future Policy	KI4, KI5, KI8, KI9, KI10, KI11, KI16.
Central Government and its Role	KI4, KI5, KI9, KI10, KI11, KI12, KI13, KI16.
Policy and Legislative Challenges	KI1, KI2, KI5, KI6, KI7, KI9, KI10, KI11, KI12, KI14, KI15, KI16.

5.3 COMMUNICATION

Sub-Topics	
	Public Communication
	Professional Communication
	Local and Central Government Communication

Communication was perhaps the most substantial and most consistent topic across all of the interviews. The interviews revealed three key sub-themes which further split and isolate the main points that were raised by the Informants. These sub-themes have been identified as public, professional and government communication. The following will discuss the relationship between this theme and the topic.

Key Informant 8	“They’re not accurate, and we need to go back and survey the levels, and there is that difference, in that respect I struggle with communicating the data to the lay person”.
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Key Informant 9	“I can remember one conversation I had where the farmer was saying they didn’t care if their farm flooded every 10 or 15 years, it was their farm, would be their children’s farm, and if that’s how it was going to be, that was how it was going to be.”
Key Informant 8	“People don’t think about it [flooding] until the waters up against their doors.”

Table 8: Selected quotations relating to the theme of communication.

5.3.1 PUBLIC COMMUNICATION

Communicating the concept of risk is a complex and challenging topic, as made clear by the literature review. KI12 stated that the critical issue was educating people that they need to live with floods, that they are not an enemy to be fought back. KI4 and KI5 echoed this statement. However the issue with communicating risk to the public lies in the fact that in the words of KI1, we are living in a period where people “expect a higher level of service, they are not willing to put up with flooding... moreover, they expect the council to respond to flooding.” These expectations clash with what KI12 viewed as the most important message that could be communicated, “We want people to recognise that they’re on a flood plain, they’re next to a river, and they need to recognise flooding is an issue, and they need to respond accordingly.” Such a view is reflective of a wider issue around the historical settlement that KI16 described and the growing expectations of protection by residents, even as the climate moves towards what KI12 described as a “more extreme period”.

In addition to the above, KI8 raised an issue with trying to explain concepts such as one in two hundred year flood is difficult, but made all the more so when the data used is inaccurate. The informant referred to a specific scenario where they found, while doing some work for a new building that the required floor level was in fact “600 millimetres out from what it should have been.” They later said that “They’re [data] not accurate, and we need to go back and survey the levels, and there is that difference, in that respect I struggle with communicating the data to the layperson.” This comment reflects the difficulty in communicating critical considerations to people who lack the background to understand the mechanics behind it.

There is a strong indication of a link between the increase in demand for adequate protection and an increase in exposure to flooding. KI5 noted that personal exposure could cause the increased concern they were seeing, and that “those affected have a different understanding”. This stance is supported by what KI9 had to say, as they noted that “when a community has experienced flooding, it is easier, third parties or new residents do require time and don’t necessarily understand the backstory and where we are today.” These views mirror the findings of the literature review, and observation that is further supported by KI16’s observation that “Flood awareness was dying off by about 2010, but the flooding in 2010 and 2015 has renewed focus on it.”

An interesting aspect to note was the division between those living in rural areas and those living in urban centres, perhaps tied to land value. KI9 noted that the most prominent concern around flooding they encountered in the rural environment came from owners of small farms and lifestyle blocks, going on to suggest that families who intended to keep farming over several generations took a more long-term view than those who planned to sell. They (KI9) recalled a conversation “where the farmer was saying they did not care if their farm flooded every 10 or 15 years, it was their farm, would be their children’s farm, and if that is how it was going to be, that was how it was going to be.”

KI11 supported this view, suggesting that those living in rural areas were more familiar with flooding and had adjusted to it. KI8 mirrored this, noting that farmers had more to lose from flooding and thus more reason to be aware of flooding. Whereas those living in town “don’t think about it until the waters up against their doors.” KI13 echoed this view, suggesting that the rural sector was more inclined to believe that works will fail, and regarded it as part of their lives, whereas many of those living in town did not have that same expectation.

KI15 challenged this stance, not seeing much of a difference at all and thought that exposure to flooding was a more likely indicator of how much thought an individual would give to flooding. KI14 had a similar view, noting “everyone is becoming more aware of the intensity of these events”. KI9 supported this, noting that there was a similar attitude to the rural sector in urban Fielding as a result of the widespread flooding in 2004 led to a comprehensive set of defences that significantly reduced the impact of the 2015 floods, further supporting the ideas put forwards by KI15 and KI14.

5.3.2 PROFESSIONAL COMMUNICATION

A number of professional key informants came from the insurance, surveying, engineering, and realty industries. When asked, all of these informants were confident that they understood the ideas behind risk and the fundamental principles behind them. Comments such as the ones below from KI4 and KI1 reflect this.

Key Informant 4	“I have a perspective that lay people don’t have, certainly from my point of view I would never consider living or working in a flood prone area. I’ve seen too much heartbreak and loss to do that.”
Key Informant 1	“I think anybody trained in an area looks at these events in a more technical light than someone just caught up in an event and doesn’t understand they dynamics behind it...if you have a technical background you can look at these events and see if there were control mechanisms which could have been better managed.”

Table 9: Key quotations regarding professionals and their approach to risk.

The comments above both show that there is a vast difference in how those trained in a field react to events compared with lay people experiencing a flood event. These comments possibly link back to the differences that some informants saw between how the rural sector reacted compared to the urban population in past flood events. A counterpoint to this is that it is more indicative of professionals being familiar with the system and the way it works. KI1, for example, noted that property developers had an easy time navigating the system and regulations around it to complete their projects due to their exposure to the regulations and requirements.

When asked who were considered important contributors to hazard management in the regions, only KI8 said contractors could be considered to be critical contributors. While KI11 also added engineers made important contributions, they referred to council engineers rather than those operating in the private sector. KI12 also suggested that there was potential for greater

involvement of the private sector, but this in the broader context of reforming river and lake bed management.

The majority of professionals considered new projects around risk management easy to begin. KI1 felt that when confined to known terms there was little trouble. They noted that this was not necessarily the case for larger scale projects which introduced additional complications, an attitude not shared by other professionals. However, KI4 noted that the “provisions and requirements of the RMA are a hindrance. While that may be the purpose, it makes getting on with work difficult”. KI8 was largely supportive of the tools made available to professionals although they noted that they were perhaps “A wee bit too generic, but what is there, we can and do use a lot.”

In contrast to the above, KI16 stated that the tools available were largely the same since the beginning of the millennium, they noted that those tools were still suitable for their given tasks and that people were “starting to use the tools more effectively”.

KI1 felt that there was a lack of coordination between local government and the private sector, noting that the last workshop around flooding they attended was “back in 2007 or so... it was a good session, but there hasn’t been anything since”. They then went on to say that more workshops and similar events would help tie the two branches together. This links with what KI4 said when they suggested encouraging dialogue between experts and lay people to increase the populations understanding of risk and how to live with it. KI8 agreed with KI1 noting that “being part of the consultation would be good, just by what they and we would get out of it. We struggle sometimes to understand the reason why they do something and what the science behind it is.” These comments indicate that a greater level of engagement between the council and the professionals in relevant fields should be explored.

5.3.3 LOCAL AND CENTRAL GOVERNMENT COMMUNICATION

The purpose of this section is to explore communication of flooding and risk by both local and central government, including communication between different government bodies at all levels and between government and laypeople, as well as between government bodies and professionals.

KI16 noted that for the local council at least, communication was a major issue. They said;

Risk can be communicated easily, water flows downhill, and this is what you need to do to deal with it. Tsunami defences are a good example of what it needs to look like, the blue lines... I think it is how we communicate that is the challenge. We need to be communicating. We need to explain what is at risk and why. – K116

The above shows that local government is aware of the issue around communication, shown by comments made by K19, who referred to an extensive public consultation period which was engaged in when the MDC was reviewing their hazard provisions. This is further borne out by comments made by K15, who noted that there was a lot of effort that went into engaging communities and stakeholders, although they noted that this had not necessarily been the case historically.

K110 offered another view, noting that many of the areas which were the most at risk, were often the hardest to manage and communicate with because the people living there were highly resistant to any attempt to persuade them to move or otherwise relocate. Their view, in light of this, was to ensure that the people living in these areas were aware of the limits of control over these factors. K111 reinforced the comment made by K19 when they discussed the difficulty in explaining the risk to new residents as they noted the difficulty in explaining the risk of living in Scott's Ferry, which after severe flooding in 2004, continued to see high demand for properties.

Communication among councils was also a concern. K12 mentioned the difficulty in navigating a system where regions differed in how they approached floods, and some Key informants, such as K16 and K17, suggested that this extended to the divide between the regional and district authorities.

K19, K15, K110 and K111 discussed this theme, noting that significant effort had been made to ensure that councils, within the same region were operating at the same level. That is, with the same understanding of legislation and policy. Though, this was not comprehensive, as noted by K19 in regard to interpretations of the Building Act.

K114 noted that often these attempts had led to the amalgamation of various councils, which they were critical of, seeing them as detrimental to local democracy and strangling the limited resources of more rural districts. They did acknowledge that their district (Rangatiki) was unlikely to be subject to this, due to its sheer size. K16 was even more critical of this trend,

commenting “God forbid we amalgamate with Palmerston North, we would be peasants then, paying for people that have no idea what happens out here until it starts to cost them money that is an attitude I have seen plenty of times.”

KI13 and KI4 also raised these issues, and both noted that there seemed to be significant conflict between regional and district councils at times and suggested that the solution would result in something closer to the unitary councils. KI4 also noted that the unitary councils were “not without their problems.”

The solution to this view is once again likely to be found in more transparent and more concrete efforts at communication, efforts which KI9 noted had been very successful following the major flood events in 2004 and 2015.

Informants also discussed communication between the central government and local government. The majority of Informants were reluctant to see the central government take a larger role in the day to day affairs of the regions. KI11 encapsulated this when stating that while greater government funding would never be turned down, they were reluctant to surrender any control over the affairs of the region to the central government. KI6 compared the decline of the power industry once the local power boards were dismantled and suggested that something similar would happen should the central government become involved in flood management.

5.3.4 SUMMARY OF KEY INFORMANTS IDENTIFICATION OF SUB-THEMES

Sub-Theme	Key Informant
Public Communication	KI4, KI5, KI6, KI9, KI10, KI11, KI13, KI14, KI15.
Professional Communication	KI1, KI2, KI4, KI8, KI9, KI10, KI11, KI12, KI13.
Local and Central Government Communication	KI1, KI4, KI5, KI6, KI8, KI9, KI10, KI11, KI13, KI14.

5.4 RESOURCES

Sub-Topics	Financial Resources
	Human Resources
	Flood Defences

The topic of Resources is broad and encapsulates several different resource types. Relevant resources concerning the topic include financial, human, and flood defence. The following section explores these topics concerning the points raised by Key Informants.

Key Informant 4	“It was a recognition that engineering solutions were not effective in that avenue. And it made more sense to abandon the settlement, as least the residential areas because it was consuming resources that were needed elsewhere.”
Key Informant 16	“There were a lot of subsidies given out to the catchment boards, and I think that is more of a question of cost benefits. I think the regional councils are in a decent place to raise funds themselves, but maybe they need additional mechanisms to raise money.”
Key Informant 13	“It is very much a resource issue, and it relates to differences between the councils. I mean look at rangatiki it lacks access to the people that Manawatu and Palmerston operate with. And I mean Martin is operating its own thing.”

Table 10: Selected quotations relating to the theme of resources.

5.4.1 FINANCIAL RESOURCES

A significant point raised by many informants (KI4, KI5, KI10, KI11, KI14, KI16) was the contribution made through the government support towards implementing flood defences from the 1950s to the 1970s (KI14). KI4 expanded on this, going on to explain that, provided “That the government could see that it was a worthwhile investment and it ticked the boxes, you could attract a pretty big subsidy and a lot of the defences in Otago would not be here without it.”

This level of government assistance was observed to have high degrees of support with some informants commenting that additional flood defence funding would “Never be turned down” (KI11). KI16 expanded on this observing that following the 2004 flooding in the Manawatu,

there was around 40 million dollars' worth of defences put in over a ten year period by local government. However, the cost of implementing these defences offers a reason why regional councils are reluctant to begin new mitigation and defence measures and beginning to favour avoidance (K15, K110).

K116 noted that while in the past, catchment boards had benefited from government assistance, almost by necessity, regional councils were not in the same position as the boards. As councils have numerous mechanisms which can be used to funds, they suggested that precise communication from local government could overcome a lack of funding and these mechanisms could be used to fund the defences.

K110 and K11 both noted that despite a central government willing to support clean-up efforts in the wake of both floods and other hazards, they suspected that the current model of a 60/40 split between the government and local government would likely be soon ending as the costs of maintaining such a system were exceeding the benefits. They noted climate change and increased land use demand as contributing factors to this decision. The contribution of the Christchurch earthquakes towards this should also be recognised.

Another dimension to the issues around financial resources are the areas that are affected by flooding, illustrated by K110's comments.

You have got a situation of at-risk communities which to intervene is going to be very costly. Millions were spent on defences in Palmerston North, but the reality is, the places that are at risk are within five hundred meters of the river. However, the people living there couldn't afford the costs, so it was spread out across the city. – K110

K111 then went on to discuss Whanganui, which is facing a similar discussion with the at-risk areas lacking the funds to improve their defences, while the rest of the city, at a higher level of elevation, does not wish to see rates rise for something that will not benefit them. This was echoed by K110 who noted that in the past it was easy to get the urban centres to fund defences in rural areas as there was a strong connection between the farming and urban community. They noted that this is more difficult these days, citing a growing disconnect between urban centres and the surrounding rural areas and the people living there.

Additionally, KI10 also noted that avoidance and the reduction in costs that it would lead to were difficult to promote, particularly in some parts of the Manawatu, citing Scott's Ferry and Whanganui as examples. The informant observed that despite the risks and dangers being well publicised and the efforts of local government to make people aware of the risks, there were still sales of houses and insurance.

KI16 observed that much of the issues around funding ultimately come down to a cost benefits exercise. This comment reinforces a point made by KI11, who mentioned a situation in Dunedin where improved flood defence in South East Valley was dismissed on the basis that improving the defences would, in turn, drive up house prices and eliminate what passed as affordable housing in Dunedin. This situation shows the difficulty that authorities face when looking at balancing the costs, both direct and indirect of flood defence.

The largest issue limiting flood management was economics, KI8 commented that "everything comes down to economics, costs that is, in the end". While KI1 suggested that the solution to these funding issues may lie with "partnering with local developers, who have as much a stake as anyone else I guess".

KI14 suggested that the solution to this issue may lie in turning to the government and allowing them to subsidise the defence of at-risk regions across the entire country, similar to how Palmerston North dealt with their flooding issues, only on a national scale.

5.4.2 HUMAN RESOURCES

This section concerns itself with human resources at the local government level. This issue is significant in regards to flood management as it, in turn, influences the ability of councils to manage events and influences the amount of knowledge and understanding which influences policy and decisions made by responding to and managing events. The section includes discussion of the knowledge and understanding of staff in relation to flood management.

Key informant 4	“My observation is, at least in Otago, they’re understaffed, I mean if that wasn’t the case they wouldn’t need us as often, but I think that is a major issue, this lack of human resources”
Key Informant 12	“Unitary councils lack resources. I think joined up local government would certainly help.”

Table 11: Selected quotations relating to human resources

A key issue that was present throughout many of the interviews was the lack of resources available to councils. KI4 said that per head of population they believed the ORC was the most understaffed council in the country, while KI12 stated that “you need to invest in resources on the ground, some councils have no dedicated river engineers for example, despite working with the most challenging rivers in the country”. KI13 further built on this citing several examples of councils that just did not have the staff or the resources to bring in the experts that they needed to manage flooding and the defences that are required effectively.

To overcome this, KI9 suggested that councils could share staff and resources to a degree. However, this again runs into the issues raised by KI6 and KI14 who worried that such a move would leave small rural communities at risk of being ignored for larger urban centres, due to the concentration of resources in areas where they will have the most impact. There is also the risk that such a move will further enhance the view that rural areas are ignored for urban areas which was expressed by KI6 during their interview.

Despite the concerns raised by KI6 and KI14, there was strong support among some informants for eliminating the separation of the regional and district councils and implementing a similar system to the unitary councils across the country. KI1 championed this approach, but KI4 was also strongly supportive of the idea, noting that while “unitary councils are not without their problems, but they work”, and felt it would be “preferable to what we have in Otago”.

In contrast, KI8 did not see much benefit in such a move, observing that ultimately flooding was an issue for the regional council to deal with, with the district councils as much users as

ratepayers. Thus, merging regional and district councils would not accomplish much. They felt that the answer there had more to do with the need for councillors to take “more of a stand” on these issues.

KI13 offered the most comprehensive answer to this question. They felt that there was a high degree of crossover regarding the duties of the regional and district councils, which often led to conflict. The unitary councils, on the other hand, did not have the same issues. As a result, the unitary councils were a better alternative to the current system. They went on to suggest a system where a separate consent organisation granted or declined consents to prevent to council from being responsible for its projects, which alongside a national regulatory planning system would allow for the entire country to be operating under the same rules and system, similar to the ideal put forward by KI2.

Another issue around human resources which was put forward by KI12, noting that there was often a lack of coordination among councils, citing a proposal to build a new development in a known floodway. They also noted that there was often confusion around which council, regional or district managed areas, explicitly mentioning issues around the Ashurst domain and cases where individuals blamed the Palmerston North council for events and rules which were put forward by Horizons Regional Council.

KI6, KI7 and KI15 all noted that despite the issues facing the councils, especially the lack of human resources, they were doing a good job, and recognised that staffing was an issue. KI6 and KI7 also noted that there was difficulty in getting a broad consensus among the ratepayers concerning the spending of money and resources. KI6 specifically cited the actions of Fish and Game as an example of people failing to see the "big picture" and failing to look beyond their interests, increasing the pressure on already thin resources. KI7 discussed hill farms, noting that there was strong opposition to the programmes such as the riparian planting operations which were intended to lower the staffing and financial costs of river management. KI13 discussed the difficulty of getting people to understand the need to get behind these environmental programmes. Additionally, staffing issues limited how much Horizons could do regarding spreading the programmes, explicitly drawing attention to its current, voluntary status.

5.4.3 FLOOD DEFENCES

Flood defences constitute a significant resource across both regions. As has been discussed previously, many were built and developed at a time when the central government was more

willing to subsidise engineering works in the regions. As a result, much of the management today is that of maintenance and repair. This attitude was especially present in Otago, where KI5, when asked, stated that there were no plans to build further defences. Citing the cost of new defences and observing that the current defences were satisfactory. In contrast, Key Informants in the Manawatu noted that while it was possible that further development of defences would take place, it was unlikely as in the words of KI16, “pretty much everywhere that needs defences have them now.” Despite this they recognised the 40 million dollar investment in further defences following the 2004 floods was a significant investment and there was still a strong climate in the Manawatu for increased defences.

As a result of the above, the focus on defence has shifted away from new developments. In both regions, local government have specified that avoidance is their priority. However, as KI12 notes, historical settlement patterns make this impossible in many areas, as do the costs.

A significant issue raised in regards to current defences were the associated costs. KI6 noted that there had been times in the past where stock, especially cattle had walked over banks and lowered their height, requiring repair work to prevent a breach. They also noted that the banks regularly needed to be checked and cleared of rabbits to prevent burrows allowing water filtration during flood events.

The largest difference that existed between the two regions was the level of sediment in river beds, in the Manawatu, this was considered the most pressing issue facing the region. Numerous informants, (KI6, KI7, KI10, KI11, KI12, KI13, KI14), stated that there was a significant issue with sediment entering the system from and causing river beds to rise. This sediment resulted in a lower level of water being required to breach the banks of the waterway and cause a flood. KI6, KI7 and KI14 all noted that preventing dredging of the beds to lower the riverbed prevented the simplest solution. KI6 noted, “Back in the 50s, you could drive a truck under the bridge going over the Oroua, park it and then stand on the truck, with a shovel and still not be able to touch the bottom of the bridge. These days you can’t even stick your head under.”

The above statement shows that there has been a significant increase in the level of sediment entering the river system due to soil erosion further upstream. The result of this has been the need to raise the stop banks continuously. So much so that KI11 noted that in some places, “they are almost too large to count as stop banks, and just about need to be considered dams.” Thus there is a clear link between the spiralling costs associated with flood defence and the

impact of human use on the environment. KI12 recognised this, adding that while dredging would solve the problem in the short term, it would not solve the underlying issue further upstream. This was echoed by KI13 who suggested that it was this issue which necessitated more funding for the erosion reduction programmes.

Another identified issue was the difficulty in securing existing buildings. KI2 spoke of the difficulty explaining to residents why insurance premiums differed between new and old developments. KI1, KI5, KI10 and KI9 also stated that while new developments were easy to manage through floor heights, storm water control and mechanisms to control and channel such development, it was difficult to manage existing buildings and secure them against flooding.

KI10 suggested that while flood proofing businesses show some potential, citing the example of the Queenstown CBD, examples in the United States had shown that this was difficult to manage and promote, especially when people who have not experienced flooding do not see the benefits in flood-proofing their homes. KI1 discussed the possibility of walking away from at risk and old homes and providing people opportunities elsewhere, although they noted that, once again, there were issues around flooding and who would pay. KI9 also noted the difficulty in dealing with standing buildings, stating that by and large opportunities to better deal with flooding only occurred when applications to modify the house were made, which did not often occur.

Overall there was satisfaction across both regions regarding current mitigation methods. KI6 noted that while it may not be perfect, people were learning and doing a little better each time, a view similar to that of KI5. While new developments are relatively easy to manage, it was existing buildings in flood-prone areas were the cause of the more significant issues. KI10 again indicated that the solution here likely lay in improving communication and understandings of flood risk, as there were very few technical solutions which were realistically viable.

5.4.4 SUMMARY OF KEY INFORMANTS IDENTIFICATION OF SUB-THEMES

Sub-Theme	Key Informant
Financial Resources	KI1, KI4, KI5, KI6, KI8, KI9, KI10, KI11, KI12, KI13.
Human Resources	KI4, KI5, KI6, KI9, KI10, KI11, KI12, KI13, KI15, KI16.
Flood Defences	KI5, KI8, KI9, KI10, KI11, KI12, KI13, KI15, KI16.

5.5 KNOWLEDGE AND UNDERSTANDING

Sub-Themes	Historical
	Climate Change
	Flood Event Knowledge

Knowledge and understanding is representative of the broader considerations that surround flooding, including the local environment, and historical factors including settlement and climatic considerations. The interviews with Key Informants identified three sub-themes. These were historical considerations, climatic changes and flood event knowledge. The following section discusses these themes.

5.5.1 HISTORICAL CONSIDERATIONS

Historical considerations were a major point raised by many of the informants. KI12, for example, noted that there was a lack of historical knowledge around past climate, all the more so because the country, and in a broader sense, the world is entering a period of uncertainty. The informant specifically made the point that data used in predictive modelling came from the previous century, a complication due to the climate of that period being relatively settled when compared to the past. Consequently, they felt the eighteenth century was a better guide to future climate. The informant then went on to discuss that alongside the lack of data from this period, there were significant differences in terms of land use and vegetation cover that made such data difficult to use effectively.

KI12 noted that “The biggest flood in New Zealand was recorded in 1857, in an un-cleared catchment, if that same flood happened today the differences would be immense.” This view is reflective of the soil erosion issue facing the Manawatu, as increased sediment in the rivers

has led to increases in the height of the river, and thus, in turn, less water is required for flood events to occur.

Land use is also a major issue. As KI16 noted, many of the major settlements in New Zealand are located close to water sources, either coastal or rivers due to the access they provided to international markets and access into the interior during the 1800s. KI14 also noted that flood-prone land is highly productive. They went on to comment the loss of agricultural land to urban settlement may exacerbate this increased risk of exposure as land is sealed and undergoes heavier settlement, placing more people at risk and reducing the available land that can allow for water permeation into the soil.

Thus, due to historical settlement patterns, places such as Dunedin and Fielding are located in flood-prone areas. Population growth has then led to the exposure of more people to potential risk which mirrors the findings of White in their study of settlement in the United States. KI14 also made the point that the country is young geologically. Due to the relative frequency of geological events in New Zealand, there is a degree of uncertainty around the shape and form of river behaviour, arguably this was illustrated during the Christchurch Earthquakes, where tectonic activity caused significant changes in the flow and behaviour of the rivers in and around the city.

The comment above shows that there is a significant issue around an absence of knowledge about the behaviour and shape of flood events. The difficulty in collecting accurate data, identified in both the literature and by KI8 does not help this, and further adds support to this being a major issue facing flood management in New Zealand.

Despite this, there was wide recognition among the Key informants that the tools that were available, both to the regional council and to ratepayers were sufficient in allowing people to see and understand risk. KI15, for example, made specific reference to the tools that are used to monitor the Manawatu River as being of particular use to farmers along the river for identifying when there was potential for a flood event.

Historical understanding of climate had a significant influence on modelling. These models were used to inform the future, and KI9 noted that when updating their current modelling to the one in two hundred year flood event level, they found that the predictions largely mirrored those of the 2004 flood event which was of that intensity.

Overall, what was revealed was that in the case of flooding, the major historical issues that are related to flood management concern past decisions. KI5 noted that previous generations could not be blamed for current issues, noting that they were merely working off what knowledge they had. However, KI13 observed that there was a need to address past mistakes while attempting to prevent present actions from compromising future flood management. KI7 provided an example of this where a farm removed a series of willow plantings which had been planted to provide a sediment trap, once removed, there was a noticeable increase in the level of soil erosion occurring along the stream bank. This shows how the past informs the present and how changes to these systems can have an influence beyond what many people initially assume, serving as another example of the complexity of flood management.

5.5.2 CLIMATE CHANGE

Climatic changes are a major topic of discussion in the present day. There is considerable debate around topics such as sea level rise, which is a concern both for Dunedin and for the small coastal settlements in the Manawatu, as well as the effects that a shifting climate will have on flood intensity and frequency, which makes predicting and modelling these changes all the more critical. These changes are already noticeable. KI1 commented that “Even in the last twenty years, Climate Change has been noticeable, I mean we’re seeing much more rainfall than we did prior to 2008. This has triggered an increased level of design, but you see more events than you used to.”

KI9 also noted this increase in pressure on the existing systems, recalling how the storm water culverts in Fielding were shut three times in 2017, something that had not happened previously and was weighing on decision makers minds.

KI10 and KI11 noted that climate change was an area that was of increasing focus as questions began to arise over what intervention in the future climate would look like, and more specifically the costs of it. KI10 then went on to say that these concerns were, at least in part why there was an increased promotion of avoidance as the first measure to be employed in managing to flood. KI11 echoed this although they once again reaffirmed that, while avoidance was the preference, they found their hands tied somewhat by historical settlement patterns. KI12 also suggested using methods such as zoning and building control to limit or even eliminate development in at-risk areas.

This echoed observations made by both KI1 and KI4 who noted that Climate Change raised further questions around relocating people, particularly in regards to South Dunedin. In contrast, KI3 suggested that due to the success of the flood defences in the 2017 flood event, the issue of South Dunedin was not as dire as it had appeared following the flooding in 2015.

KI8 also noted that there had been some effort made to account for the predicted changes, identifying new retention ponds and an increased focus on effective storm water management in the Manawatu. KI8 then went on to say that the solution to increased flood events from climate change lay with effective infrastructure. They noted that while avoidance would be preferable, there were immense difficulties with its promotion due to past settlement and pointed out that limiting new development would not solve the underlying issues around existing settlements which are in at-risk areas, also noting that current flood mapping may not reflect the range of future flooding considering climatic changes. Thus, in their view, there needed to be an increased and more comprehensive attempt at storm water neutrality. The informant did make the point however that, at least in their view, the councils were aware of the risks and attempting to deal with them based on the knowledge and resources available.

KI16 stated that there were many mechanisms in place that were intended to account for climate change, they identified it as an increasing area of focus for several of the Crown Research Institutes including NIWA and GNS. Going on to say that fluent and comprehensive use of the modelling and predictive tools were providing greater confidence in predicting the effects and consequences of climate change. Although they once again stressed that there remained a degree of uncertainty around the topic, even if that uncertainty was significantly lower than it was in the early 2000s. They also noted that it was mainly an issue for the regional councils to deal with and that district council were limited to ensuring that storm water systems could account for an increase in the amount of water moving through the systems.

KI5 echoed concerns about a lack of information, stating that, “more information about when and what changes will always be helpful”. They went on to add that many of the new tools that were coming out to address and help model these changing were more focused on Greenfield issues and to a degree an increased focus on tools to help manage adaptation measures were of more immediate use.

5.5.3 FLOOD EVENT KNOWLEDGE

On the whole, the majority of informants considered themselves to have a good understanding of the processes and nature of flooding. KI5, for example, pointed out that within Otago, they were not discovering new flood prone areas and they had a good understanding of which communities and areas were subject to flood events.

Other Key Informants mirrored KI5, KI10 for example, noted that there was very little mitigation work that was yet to be done, while KI14 stated that outside of completing the last of several retention dams, the Catchment Boards and Regional Councils had mostly achieved all viable mitigation measures. Which echoed KI5 comments that the mitigation works that could be built had been, and the focus had shifted towards maintenance and regulatory management rather than hard defence.

KI12, however, did raise a point in their discussion of the issues affecting flooding. They stated that part of the issue and the difficulty in engineering the needed change in attitude that is required to better deal with the changing circumstances around flood management. They noted that many of the people involved in river management do not have a background in the subject, instead of coming from a past in transportation or forestry engineering and have no understanding of how rivers operate. Accordingly, there is a need to upskill many of the individuals involved in river and flood management to ensure that they can understand and manage the complexities of the river systems of which they are in charge.

KI12 went on to explain that they felt the future of flood management lay in developing a more holistic approach that existed across policy, management, application and public perception. However, they noted that this required a significant attitude change that would likely not occur without more flooding and the losses that would come with that, this is due to the difficulty in getting people and communities to talk about flooding, without a flood event occurring to provide the stimuli to begin that conversation.

KI13 concluded their interview by noting that many of the environmental issues facing the country are interrelated and speculated that the correct approach would be accounting for the needed regulations and attitude changes and then creating a single piece of legislation that is flexible enough to manage all of these issues, similar to the Horizons One Plan. They noted that much of the work of the former Parliamentary Commissioner for the Environment provides a

path and mechanisms to manage these issues in a comprehensive and dynamic form that would suit the present and future needs of New Zealand.

5.5.4 SUMMARY OF KEY INFORMANTS IDENTIFICATION OF SUB-THEMES

Sub-Theme	Key Informant
Historical	KI1, KI4, KI5, KI8, KI9, KI10, KI11, KI12, KI14, KI16.
Climate Change	KI1, KI4, KI5, KI8, KI9, KI10, KI12, KI15, KI16.
Flood Event Knowledge	KI1, KI4, KI5, KI8, KI9, KI10, KI11, KI12, KI13, KI16.

5.6 CONCLUSION

The issues discussed above cover a broad range of topics and are reflective of the complexity of flood management and the variety of disciplines and topics that it covers. Despite the separation of the issues into key themes, it is clear they profoundly inform one another. While a lack of resources are arguably the most significant limitation on effective management, it is clear that the themes and subthemes discussed here have all contributed significantly to the breadth and width of issues that New Zealand faces today in regards to flooding.

Despite this, there is a clear understanding among the Informants of where the gaps are and what needs to be done to fill them. There is a deficit in terms of the ability to predict future events. This deficit is not unique to flood management and can be seen in other environmental issues, particularly when taking the high level of uncertainty around future climate into account.

6 DISCUSSION

6.1 INTRODUCTION

Both the document analysis and interviews with key informants have provided a range of data relating to current and future flood management, in both Otago and the Manawatu. This chapter focuses on exploring how the data collected over the course of this research relates to the concepts and arguments in the literature review (chapter two). Divided into four sections, each of the topics in this chapter relate to the themes in the literature review (chapter two) and the research questions that shaped this research. These are: rural and urban flooding, flood policy and mitigation measures, risk and hazard management and flooding in future climates. These topics were chosen for their role or perceived role in shaping flood management, historically, and in the present. Additionally, these concepts play a significant role in influencing what shape future response may take. Thus, discussion of these themes is a critical factor in understanding the mechanisms of flood management and answering the research questions which have shaped this research.

6.2 RURAL AND URBAN FLOODING

This section explores divisions between the rural and urban sectors, concerning both residents understanding of flooding and the management strategies employed in both sectors. The topic relates to the first section of the literature review, as well as answering the second research objective established in chapter one. The section explores this proposed rural and urban divide and the issues in these sectors in addition to discussing floodplain settlement and the transition of rural land to urban settlements.

In the results, there was little to indicate that there was a significant difference in how flood management differed in rural areas compared to urban centres. On the whole, informants indicated that both those living in rural areas and urban areas had similar expectations regarding the response to flooding. While some informants suggested that those involved in agriculture would have lower expectations or a greater appreciation for the difficulties in flood management, this did not appear to be true. Instead, what key informants considered the most critical factor in influencing expectations around flood management was the level of exposure to flooding, with those who had experienced flooding themselves, or had immediate family affected, more likely to accept and understand the mechanics behind flooding compared to those who had not. KI9 illustrated this difference referring to the different approach between

residents who were present for the flooding in 2004 compared to residents who moved to the Manawatu after the event, a view consistent with other informants, both in the rural and urban sectors.

The statements of KI9, suggested that rural residents have a better appreciation for flood hazards due to higher levels of land ownership and the nature of their daily lives, in areas which are unlikely to have the level of drainage and water management systems that urban centres have. Drew (1983), Hess and Morris (1998), and Posthumus (2009) indicated that there was a significant impact on crops and livestock in the event of flooding. The research did not appear to support this position, however, with the informants who had contact with the rural community noting that these impacts were confined to specific areas, with one, KI6, stating that during the floods of 2004, stock losses only occurred in low lying coastal areas.

Thus, while stock losses have occurred historically, the informants indicated that it is limited both geographically and by the scale of flood events. There is a stronger argument to be made regarding the effect that sediment has on soil, with KI14 noting that following flooding in 2004 this was the most significant issue they faced. Even then they did not consider it to be a significant issue and commented that aside from wishing that there has been more fertiliser in the soil, it merely meant another job needed to be done, the same as fixing fences or any other chores that came with farm operations. This view mirrored the points raised by Förster (2008). Local conditions and the context in which they occur limit these findings. Consequently, these observations are unlikely to reflect the general pattern of flood impacts, both nationally and between different flood events, as these events occurred with the Manawatu floods of 2004.

It is likely, based on evidence in the literature, that as a result of the minimal impact that flooding has on the agricultural activity in the selected areas, there was little separation between the rural and urban groups concerning flood understanding. However, the fact that the study areas have both experienced significant flooding within a reasonably recent time frame could potentially contribute to a higher degree of awareness among urban residents, aligning with the views put forward by KI16 and Siegrist (Siegrist and Gutscher, 2006). Specific aspects of the floods and the events surrounding them are also likely to play a part. The Manawatu floods are notable for causing significant damage to infrastructure such as bridges around Fielding, while severe flooding in South Dunedin necessitated the use of canoes for transport. Future research could explore this by expanding the research topic to areas which are not prone to urban flooding and assessing these regions against flood-prone regions.

Local conditions add to the discussion around the settlement patterns of the floodplains of the Manawatu and Rangitikei rivers which encompasses much of the Manawatu and place significant areas of land at risk of flooding, this has placed settlements, regardless of their location at risk. White (1958) stated that exposure typically resulted in further investment in mitigation measures when conducting a study of American cities within flood plains. The development of further flood defences in Fielding following the flood of 2004 mirrors White's observations. White (1958) also argued that mitigation investment would fuel further development in high-risk areas. In Fielding, while there has been significant development over the last decade, this development has typically occurred in elevated areas around the town, rather than in lower cost, at-risk areas. Future development is also unlikely in these at-risk areas as the Manawatu District Council (MDC) has stated that as part of its new plan, development sites were chosen based on their flood risk, informed through the use of LIDAR and the resources of the Horizons Regional Council. The actions of the MDC show the role that land use planning can have in preventing the situations discussed by White (1958).

Graff (1976) discussed the loss of permeability that occurs as areas become more urbanised and concrete and other sealants cover the previously permeable land. In both Otago and the Manawatu there was a significant focus on reducing storm water, from both existing urban areas and new developments. KI1 and KI4 both identified projects relating to improved storm water management as significant features of their work in Urban Otago, while KI8 stated the same thing for new developments in Fielding. Based on their commentary and that of the informants who work in local government it is clear that new developments, both business and residential, are increasingly developed in ways that aim to limit their impact on water runoff and permeability loss.

Rather than new developments, Informants identified older buildings as having the most significant risk of flood exposure. These issues included ongoing costs regarding repair, as a result of being located in high-risk areas, or significant spending and insurance costs to adequately protect these developments further impacting housing affordability and possibly limiting the availability of lower priced houses in urban environments. These pricing issues were revealed to be a fundamental issue facing urban flood management and an issue that the local authorities struggled to accommodate.

What the research has shown in regard to urban and rural flooding is that there is little difference in how rural residents perceive and respond to flooding when compared to their

urban counterparts. The actual difference appeared, based on the comments put forward by KI9 to be a division between people who wished to pass their property on to the next generation and those who viewed it as an investment. An adversarial approach to flooding was prevalent among individuals who saw their property as an investment. This attitude towards flooding is potentially tied to issues around house values, whereas this was not a concern to individuals who wished for their children to inherit their property. The divide between the rural and urban sectors came from rural properties being more likely to be passed down to children due to family farming traditions and similar attitudes than any innate understanding of flooding and risk among the rural community. The behaviour of individuals living in smaller rural properties, such as lifestyle blocks, supports this view, as according to KI9 the majority of these residents viewed their property as an investment and were conscious of actions that might influence the resale value of the property.

Informants, particularly KI15, raised the transition of rural land into urban land as a concern. While not identified as a critical issue in the study areas, informants noted that there was a tendency across the country for urban centres to expand into agricultural land. This transition presents several long-term issues. There are complications around local food supply and the decline of land to produce locally, but there are several which relate directly to flooding.

Urban expansion limits the availability of unaltered land to absorb excess runoff and requires man-made modifications to accommodate the excess runoff generated by new urban growth. In addition to this, there is the potential for future growth to lead to increased expectations of protection as land which is flood-prone but which was previously occupied by long-term residents gives way to individuals seeking to either inhabit the land for a short period or seeking to profit off the land. This change in residents will lead to increased expectations for protection in areas where previously limited or even no additional flood protection was required. This transition is of particular concern in floodplains, where there is already a higher level of exposure due to land clearance and other actions which have previously compromised the ability of the land to absorb and accommodate the excess water generated in flood events (Hewlett and Doss, 1984). Population growth also inevitably leads to higher concentrations of people in potentially at-risk areas.

The research has shown that while there are some differences between how rural and urban sectors view and react to flooding, they are not significant. Understanding of flooding does not appear to differ significantly between these groups either as a result of people choosing to live

in rural or urban environments. The differences, instead, are found in the type of damage that flooding causes and differences in how land is owned and operated, with the rural sector more likely to see damage occur to private land, while urban centres are more likely to experience damage to public property. This difference then has more to do with property rights and the nature of the private and public property divide than any inherent difference in the way that people react and deal with flooding, in any significant terms.

6.3 FLOOD POLICY AND MITIGATION

This section discusses the research findings concerning both flood policy and flood mitigation measures. A significant topic in chapter two, and the third research objective guiding and shaping this research, mitigation, and policy are important factors in flood management. This section concerns itself with the five components discussed in chapter five as well as the influence that factors such as population growth and environmental management have on the overall shape and direction of flood management in the Manawatu and Otago regions.

There has been a significant effort to change flood management system and shift towards more risk-based systems. Such systems would rely on land use planning, and represent a movement away from the historical practice of using large-scale engineering projects to mitigate flooding. However, there was relatively little to show for the promotion of this interdisciplinary method (Mileti and Gailus, 2005). This slow adoption of the method may be because it represents a radical departure from previous models. Additionally, as noted by KI12, the people involved in flood and river management often come from transport and forestry backgrounds rather than water management and bring a strong faith in physical defences at the expense of these holistic approaches.

Mitigation remains the primary method of managing floods. While resistance to further mitigation projects is growing, Informants indicated that this is more because of a lack of viable projects than a movement away from mitigation. An example is the improvements made in Fielding following the flooding in 2004, and this suggests that there is significant support from both lay people and local government for further mitigation measures. However, the lack of opportunity for new projects, in turn, means that mitigation will shift towards maintaining current defences, especially as there is now a well-developed information base around the country for identifying areas at risk of flooding and the severity of that risk.

There is concern among some academics (Whitfield, 2012), and among some informants, (KI5, KI11, KI12), that changing climate conditions will contribute to increased flooding, rendering old data redundant as flood patterns change. Increased land use and land clearance add to this, and urban growth will further complicate this issue. The 2017 flooding of Houston, Texas, serves as a compelling example of the consequences of increased settlement in floodplains. The case of Houston, and the comments made by Brandt concerning Sacramento, California (Brandt and Clark, 2012) effectively illustrate the relationship between historical settlement patterns and flood risk. This situation is particularly significant in the Manawatu, where due to the number of rivers within it, significant areas are prone to flooding. Otago too, has vulnerable areas, including the Taieri floodplains and South Dunedin. This has placed both rural and urban communities at risk and required significant investment to mitigate. Examples of this include both Fielding and Palmerston North, while Whanganui illustrates the consequences and issues of insufficient mitigation measures and its impact on people.

Adaptation received little attention from planning documents compared to other methods of managing flood events. While this is an increasing area of focus, reflected in the way that the representatives of the Regional Councils both specified that their overarching goal concerning flood management was to ensure that people are not put at risk and water was prevented from reaching areas where there were people. This attitude shows that while mitigation seems to remain dominant, there is an increasing level of acceptance and the beginning of what may come to be enforcement of a position where flooding is a natural event requiring careful management rather than an obstacle to be overcome or outright prevented (Mileti, 1999). With this said, it is clear that adaptation measures are a relatively new idea and one that has not had enough time to develop and be incorporated into the response of local governments. Part of the issue with adaptation is that adoption of the component would require a significant shift in that attitude and approach of people, many of whom are unlikely to be willing to accept that they need to change their lifestyles and behaviour. This difficulty in changing lay people's attitudes links back to the issues that KI2 raised in regards to the difficulty that insurance companies have with communicating risk and the calculations behind insurance premiums and other costs.

Avoidance had significantly more presence in both documents and popular understanding. However, this component runs into similar issues to that of adaptation, with difficulties arising due to historic settlement and the desires of individuals to choose where and how they live. There is a broader discussion here around how liable someone can be in regards to risk when

they choose where to build their homes and live their lives. Both regional councils noted that this was an issue, and raised concerns that the cases around this topic, passing through the courts would potentially result in the council needing to accommodate the risk of these settlements, despite the costs and conditions that that would require.

Ideally, avoidance would be actively encouraged and could be used to phase out the settlement of at-risk areas slowly. Such an undertaking is an ambitious goal and one which is unlikely to be easily applied in light of other considerations. These considerations include the costs, both to local authorities and individuals, as well as questions concerning the location of new settlements, and who would fund their development. Additionally, it is likely that there will be people who refuse to move, due to financial and emotional attachments, as well as people willingly moving into these at-risk areas due to low costs. This scenario then raises questions around the degree that local authorities would be expected to maintain defences in these at-risk areas. Such a situation could lead to local government continuing to pay for mitigation measures, as well as incurring the costs of developing new settlements away from at-risk areas.

Social capacity building was another component that received little focus concerning flooding. This was despite councils recognising the usefulness of the component, and efforts made to engage the broader community when planning for events and in the immediate aftermath. An example of this is the effort in Dunedin to establish what residents consider acceptable risk and town hall meetings in both regions following flood events, yet little conscious effort was made before events to develop or promote community awareness around flooding or how individuals might better prepare themselves for these events. While in the regional and district plans there were several policies aimed at improving the level of detail and range of information available, this did not appear to extend beyond improving the capacities of the authorities to monitor flood risk. While this information is available to the public, and there are significant resources available to them, there does not appear to be a dedicated programme aimed at educating vulnerable communities, this extends even to those individuals working in professions directly related to flooding, as evidenced by the comments made by KI1 and KI and KI8. The documents also gave some indication, at least at the regional level, of growing efforts to explore what residents of these areas consider an acceptable level of risk, which could lead to further conversations that may contribute to the discussion around Social Capacity Building.

What the above indicates is that there is an opportunity to put more emphasis on making people aware of the flood risk in areas they are living in. However, it also raises questions,

including, how does Social Capacity Building align with the tendency for individuals to ignore flood risk until they are personally affected, a view supported by several academic articles as well as this project (Perry and Lindell, 2008; Becker et al., 2014). This means there is little benefit in promoting social capacity building, except following events where the personal experience will allow for the needed sense of personal involvement. There is perhaps more room in this sense to develop better relations with experts working in the private sector who, due to the nature of their work can be expected to have a better understanding of risk and which areas are likely to be at risk of flooding. Although based on comments made by Key Informants, these experts are themselves unlikely to be members of at-risk communities so it is debatable as to how effective this will be at developing more robust communities. Although there are obvious benefits in developing links between the private sector and local government, both for pre and post event response in a more general sense.

The final policy component, climate change also received little attention. When evaluating policy documents, it was clear that at their time of publication there was little information available, which in turn meant that policy aimed at developing an understanding from which a response would be developed and implemented in future documents. With three of the four documents that were evaluated currently undergoing revision, it makes sense that a more complete and targeted response to the issues of climate change, including flooding, will be found in these documents. The level of attention that climate change received in the Horizons One Plan, which recognised climate change as a significant issue that would have many consequences for the region, including several related to flood management, indicates this. Thus, using the One Plan as a model, it can be assumed that new documents will provide a more comprehensive and accurate response. Additionally, there is now an active and growing body of academic literature which provides guidance on what changes might occur and what they may mean for specific regions concerning climate change (Whitfield, 2012).

The responses of informants reiterated these findings, recognising climate change as an issue that would likely require new styles of management to accommodate future flooding. What was emphasised in these interviews was the high degree of uncertainty around climate change and its impact. This lack of information is the key issue concerning a lack of policy development. It is possible that an increase in the frequency of floods and their intensity may have the consequence of resulting in an improved awareness among lay people of what areas are flood prone and what the level of risk that they are willing to live with is. Overall there is significant room to develop future flood policy and take the potential impact that climate change will have

on flooding into account. It is debatable how effective such a policy would be if pursued at the national level, due to the unique nature of catchments as well as the variety of issues faced by each region. Consequently taking a one size fits all approach to flooding is unlikely to be able to effectively accommodate the complexities that are a part of flood management.

One aspect of policy that was not evident from the outset was the range of issues which are related to flood management, without necessarily being a part of it. Issues around soil erosion, as well as public understanding of which authority holds responsibility for defensive works and areas which are involved in river and flood management all indicate that flood policy is not a topic which is easily isolated. A further factor to consider is education around the role of local government. Based on this, the increasingly interdisciplinary approach to flood management makes sense, as settlement patterns and the nature of local government in New Zealand and around the world have resulted in a complex range of issues which need effective management. This process has been occurring for decades, and White and Hass were merely likely the first to recognise this process. Thus, the transition of rural land, which traditionally has had a low population density to urban, is simply another factor to consider.

The most prominent of these is will urban expansion lead to a renewed focus on mitigation measures? White (1958) focused on the continental United States and potentially population growth in New Zealand may lead to similar development patterns (White, 1958). If this proves to be true then there is a chance that in the short to medium term, there will be a return to mitigation efforts by authorities as population growth requires more substantial protections and the development of additional mitigation measures in areas where previously they were not needed. Overall, while New Zealand has mirrored the mitigation practices and building patterns of the United Kingdom and the United States, population differences have limited the scope of these factors. However, this may change in the future where a growing population may lead to a movement away from avoidance. Climate change is a complicating factor here, and this decision may owe more to the influence of the climate and practical realities than the demands of residents.

6.4 RISK AND HAZARD MANAGEMENT

This section discusses the research relating to the third major theme in the literature review, risk and its relation to hazard management. Furthermore, the section relates to the fourth research objective, which investigated the role that risk played in flood management. The following section explores understandings of risk and any differences between rural and urban

sectors in their understanding of risk. Discussion includes the differences between lay people and professionals regarding risk understanding and the difficulties in communicating and discussing risk and what it means. The section includes complicating factors including education and property rights too.

One of the research questions that guided this research wished to explore the difference between how rural and urban communities understood and dealt with flood risk. The collected data found little that distinguished the two communities from each other, this extended to their perceptions of risk which were not considered by the informants to differ in a significant fashion. Instead, it seems that home ownership and property investment are more influential in shaping risk understandings, this was not developed in the interviews, though it is a recognised factor (Siegrist and Gutscher, 2006). People who had previous experience of flooding had a better understanding than those that did not, with KI9 noting that there was a difference between people who lived in the Manawatu prior to 2004 and those that arrived after the floods concerning the level of preventive action that they were willing to adopt. This statement appears to support the argument put forward by Lindell and Hwang in 2008 which argued that emotional impact, such as experiencing flooding personally, drove improved understandings of the hazard (Lindell and Hwang, 2008).

Due to the role that personal experience plays in understanding flood risk, it could be argued that the slight differences between rural residents and their urban counterparts may be because of increased exposure to flooding. This would explain the slight differences between the two groups while aligning with the findings of Messner (2006) and Bann (2004). This is difficult to analyse further with the collected data, because the majority of the informants focused on urban flooding and those that did not, or lived in rural areas themselves, were located on or near major rivers which were prone to frequent flooding. The exception to this, KI7, was notable in that despite coming from a rural background, they did not consider flooding to be an issue, specifically saying that they had never had any major floods on their property. Based on this, the collected data aligns with the points made by Messner (2006) and Bann (2004).

Siegrist (2006) identified that lay people and experts often understand risk and flooding differently. This argument was consistent with comments made by KI1, KI4, and KI8. These professionals noted that they had a more developed understanding of the process and stated that this, in turn, impacted on how they chose to live their lives, stating they tended to prioritise

low risk when purchasing a property. This suggests that education is a positive way forward in promoting understanding of risk and developing a more risk-aware population. However, there is also the chance that even without realising it, what is driving the decisions these experts make is again the exposure to hazard events rather than their academic understanding of the process. In this case, due to interacting and communicating with people who have suffered losses and damage to their homes and property, as well as exposure to the effects that flooding on the natural environment, professionals could be influenced by these factors rather than academic knowledge. This would mean that the concepts explored by Baan (2004) and Messner (2006) hold more influence than those of Siegrist (2006). It is more likely that the real answer lies somewhere between these two differing points and both contribute to this understanding, although the exact composition is difficult to determine. These findings again reflect the main points identified in chapter two, particularly the arguments made by Mileti (2005) and Raaijmakers (2008) about the difficulties involved in understanding risk and the reactions of groups to risk.

A major topic identified in the research was communication, especially of risk. Communication to the public was one of the most significant issues facing flood management. In particular, the observations made by KI1, KI4 and KI8 in regards to communicating ideas around risk and how to understand risk mirrored the points raised by Siegrist (2006), Catto (2008) and Tully (2007) who stated that understanding of risk declines over time. The movement of people into flood-prone areas following flooding supports this, as evidenced by the comments made by KI9. This represents the fundamental issue of risk communication which requires a well-developed understanding of risk, yet at the same time, there are considerable difficulties in promoting a situation where people can accurately grasp the principles behind risk management. As KI12 noted, consciously exposing people to flooding is neither a viable nor ethical solution to this issue.

A lack of connections between practising professionals, lay people and local government further limit communication of risk. Ideally, these groups would be engaging in discussions aimed at dealing with flooding. Instead, communication typically only follows events which are of a sufficient magnitude to affect residents and necessitate a response. Both the Manawatu and Otago follow this pattern, where town meetings following floods are typically used to detail the response and recovery times and civil defence measures. However, it is significant that these community engagements tend to occur following events rather than before flood events. This established practice contrasts with the efforts made by the Bay of Plenty regional council and

their attempt to encourage the broader community to engage with and understand the processes behind risk (Kilvington and Saunders, 2015). These efforts have only received attention since 2014, and it is likely that without the constant exposure, awareness will eventually fade from the public consciousness.

While discussions and education around acceptable risk are effective in establishing what limits of risk people are willing to accept, it does not contribute to solving the underlying issue with settlements and residents located in high-risk areas. In particular, residents of high-risk areas in lower socio-economic brackets are unlikely to have the means to fund the recovery themselves. Consequently it falls to other residents, to subsidise the recovery from an event which the insurance sector are increasingly coming to view as a regular occurrence. In response to these issues around living with risk, there is perhaps more merit in promoting conversations and links between consultants and local government, particularly around future development goals. This offers opportunities to ensure that those involved in development are aware of the goals and aims for the management of flooding and associated defensive measures. While arguably this is already provided through planning documents, this proposal would allow for consultants to have their views heard and promote a stronger public investment into what councils wish to promote and encourage concerning development goals. This would also provide mechanisms to meet and attempt to satisfy the issues that raised by Key Informants, themselves consultants. Efforts would need to be made to ensure that interested individuals felt that they were able to contribute to these discussions, but the main aim would be to promote a unified and consistent approach in regards to flooding, both in business and in government.

Plate (2002) stated that flood management is; "In a narrow sense is the process of managing an existing flood risk situation. In a wider sense, it includes the planning of a system, which will reduce flood risk." (Plate, 2002, pg 3). This comment accurately summarises the approach to flooding made by the local government in both areas. However, how they approached reducing flood risk did vary, with the Otago region stating that they wished to reduce exposure of people to water and thus reduce the likelihood of flooding affecting people. The Manawatu, on the other hand, had a different approach. Due to the geography and settlement patterns, they placed a greater emphasis on ensuring that defences were in place and warning systems were operational to inform residents of when flood events were likely to occur. In essence, this was a clear example of a regional authority embracing the principle of living with flooding as they

acknowledged that in many cases, moving people away from at-risk areas was not a viable option, though there was a strong lean towards mitigation measures.

Long-term an event that will exceed the defences will occur, rendering these defences useless. However, when and where this event occurs is difficult to pinpoint. Also notable is that the approaches in both areas are part of a more extensive set of programmes aimed at promoting and developing a more holistic approach to flood and environmental management. Therefore it can be concluded that there has been a movement away from past management styles and towards one which views flooding as part of a wider lens with numerous components which need effective management. Some Informants raised questions around how effective management can be when numerous organisations, often in conflict, are expected to work together to deal with cross-district boundary issue closely interrelated to other concerns, such as urban growth, soil management and water management. Consequently while there has been a significant movement towards this new management style, there are still flaws in the system, and there are many questions about how to effectively integrate a management style such as this into the overall political system of New Zealand.

The conversations with Key Informants also made clear that there are increasing attempt to use land use planning to manage floods better. However, boundary issues and private property rights which have, at times complicated this. For example, KI12 referred to the abandonment of a proposal for better flood management along the Hutt River because residents refused to sell their houses to the local government body. Additionally, KI13 suggested that property rights were a complicating factor in these situations which made addressing flooding hazards more difficult than they might otherwise be. Another factor is that any move to limit or remove property rights is unlikely to have popular support and accordingly, unlikely to advance in the central government. Thus, it makes more sense to move away from this line of thinking and towards other avenues of thought which are more likely to achieve the aims of flood management without requiring a significant change in New Zealand law.

There is clear evidence of the adoption of ideas that were proposed in the late 1990s in regards to land use planning and its potential benefits to flood management. For example, the ideas that promoted by Burby was in 1998 can be seen in the approach of the Otago Regional Council and its commitment to “Keeping people away from water and people away from people” (KI5). However, there are several issues. Population growth and economic development remain limiting factors regarding movement towards this management style, and this is unlikely to

change as both regions state that they are committed to fostering the economic development of their regions. White (1958) and Baan (2004) argued that development would, in turn, lead to settlement of land which is prone to flooding and necessitate significant protection which would, in turn, limit the benefits of the development that is occurring (Baan and Klijn, 2004; White, 1958). Interviews with Key Informants suggested instead that rather than new development, which can be controlled through planning and use new technologies to reduce their impact on water permeation, it is older buildings built in areas built in high-risk areas that are driving up costs. These costs arise through ongoing expenses from mitigation works and repair fees. As climate change becomes more of a factor, it is likely that the costs associated with flooding will rise. However, new developments are likely to be better able to withstand the effects and better manage the flooding than older developments.

Predicting and modelling future costs is further complicated by the fact that data remains speculative, and issues around data collection and how effectively it can model future climate scenarios remain. The analysis in chapter four identified this issue. Furthermore, several Key Informants, specifically KI8, discussed the issues that bad data caused in the present, as well as the difficulty of planning for a future climate that is difficult to predict accurately.

6.5 FLOODING IN FUTURE CLIMATES

This section discusses and explores the relationship between climate change and flooding. It has a secondary purpose of discussing the influence that climate change has in shaping future policy and its direction. This topic relates back to the fourth topic in the literature review and answers the fifth research objective that was used to shape and inform this research project. This section discusses the relevance of climate change to flooding, its relationship to the components of flood management discussed in chapter five and the relationship of both lay people and professionals to climate change. The section concludes by briefly discussing land use and climate change.

Climate change is a growing topic of conversation in science. Flood management is closely connected to climate change as it is dependent on hydrological processes which influence the location, duration and intensity of flood events. This view enjoys academic support from the IPCC and other academics (Whitfield, 2012; Intergovernmental Panel on Climate Change, 2014). The result of this has been a growing interest in modelling future climates to determine what the consequences and effects of these changes will be. However despite this recognition, there is significant confusion about the exact nature of these changes and precisely what the future

climate will look like (Whitfield, 2012). The influence climate change will have on the future climate can be seen in other concerns, such as sea level rise, which has several different models and scenarios.

This observation was present across both of the research methods used. Climate change scored poorly in the assessment of planning documents (chapter 4), with the majority of those documents simply identifying it as a future issue and calling for more information to shape a response. This attitude does not appear to have changed over the last decade, as shown in the interviews held with local government representatives. These interviews reinforced the view that climate change was a growing issue with few solutions. Furthermore it was difficult to predict consequences in the regions due to the variability between them. Despite this, as the second generation plans come into effect, it can be expected that there will be significantly more content around climate change and the problems that regions and districts will face responding to it. The Horizons One Plan supports this proposal, as the most recently produced plan, it contains significantly more content around climate change and responses than the other analysed documents. Additionally, it is worth noting a significant shift in mood and awareness around climate change since the publication of the first generation plans to today, where there is more attention paid to climate issues.

There is still a lack of clear and concise data around what the specific effects of climate change will be, especially with regard to flooding. This makes planning a response difficult, beyond the simplest plans, such as preparing for larger and more frequent floods. During the interviews with some key informants, they mentioned that mitigation spending would likely decrease in subsequent years as costs moved away from new investments and turned to maintaining legacy defences. Should the climate change significantly, there is potential that this freeing of capital for other investments will not occur. The reason for this would be a result of changing flood risk requiring new defences and protection measures in new areas, or previously low-risk areas becoming high-risk. Adaptation, avoidance and social capacity building would then see less investment than they might have due to increased demand for mitigation measures.

Despite this, the changing climate offers opportunities to promote avoidance. If more land or previously settled land comes under greater threat of flooding, then there is potential for local and regional government to use these events to encourage the abandonment of settlements and land which is now considered to be outside of acceptable levels of risk. However, avoidance is continuously working against a very human reaction and desire to maintain control over one's

possessions, encouraging resistance to it. It is possible that similar patterns will occur with adaptation and social capacity building, although those components are more dependent on the willingness of the local government and individuals to adapt.

Both interviews and the document analysis indicated a consensus that changes to the climate are occurring. However, there is a distinction between lay people, and professionals. For example, lay people noted changes to waterways they are familiar with, and the impact these changes have had on infrastructure such as bridges.

In contrast, individuals working in professions directly related to flood management, and academics who focus their studies on water systems were able to elaborate on the issues and challenges that climate change presents in more detail. However, the information they presented, in the interviews, did not identify any new issues relating to flood and water management. There was some discussion about the difficulty of collecting accurate data, which relates to the subjects raised by Downton et al. (2005), and Whitfield (2012), further complicating the study and collection of data due to the differences in catchments and between rivers. The result of this is that it is necessary to make some assumptions about the river, particularly during flood events where there is a significant danger to researchers during data collection (Whitfield, 2012). This complication causes a risk. This risk is that the data, used by both by professionals, local government and academia, is not necessarily an accurate reflection of the event. The major issue that this brings is that it, in turn, raises questions about how successful the models used to predict future flooding and its relationship to climate change is, when the data is not necessarily an accurate depiction of the current situation.

There is recognition that data uncertainty is an issue concerning modelling climate change (Downton et al., 2005), this was reinforced by KI8 in their interview. In fact, the issue seems more pronounced than was initially assumed, in KI8's view, these assumptions seem to contribute to issues that arose during the development of new buildings and in turn complicating the use of the rules and regulations which are intended to monitor and guide this process. Another issue which was not clear in the literature, but is clearly a major issue in New Zealand, is the difficulty in isolating flooding from other factors. The most prominent example of this are the issues around sediment load in river beds leading to larger floods as the river bed is artificially raised. While there is a short-term solution in dredging these rivers, a position supported by the majority of lay people, as well as Smith (2001), there is a more fundamental

issue around land use and the intensity of that use which needs to be dealt with before this issue can be solved.

The difficulty in isolating flooding from other events reflects a significant issue in flood management. Flooding is not an event that occurs in isolation. Historical land clearance had led to catchments which can no longer support rainfall in the same quantity as the past. Secondly, the movement of people into these areas, combined with a growing population and urbanisation process, has resulted in significantly more individuals being placed at risk and as a result driven a need for appropriate defences. Combined with this, the resulting lack of vegetation has, at least in the case of the Manawatu, resulted in significant impacts on land, namely in the form of sediment erosion, which has resulted in sediment from further up the catchments entering the river system and raising river beds downstream. These factors further complicate models which are intended to predict the influence of a changing climate on flood events as it is challenging to separate factors influenced by land use changes from changes in the climate (Whitfield, 2012). This then raises the question of whether flooding should be considered a separate issue from land use, or if the two are intrinsically bound together.

6.6 CONCLUSION

The objective of this chapter was to relate the findings identified in the results chapters to the major topics discussed in the literature review. The overarching goal of this research was to investigate the flood management practices of local government and the influence that a slow change in approach to risk-based management has had on the practices of both local government and professionals working in related disciplines.

The research has highlighted the interconnectedness of flooding to other factors, the most important and prominent of these being land use and population settlement patterns. Additionally, it has highlighted the influence past actions and decisions, sometimes made with inaccurate or incomplete information, have and continue to exert on present management practices.

Both the policy analysis and the interviews with key informants indicate that there is a slow transition towards risk-based approaches and support among both local government and outside professionals for this transition. There is also growing recognition that flood management is a field which involves many disciplines and requires input from a range of individuals to ensure that the right solution which meets the needs of residents. This finding

supports the research of Glavovic et al. (2010) regarding the direction of New Zealand flood policy and shows strong support for the social perspective that White and Hass argued was previously missing in flood management (White and Haas, 1975).

Issues remain with the policy documents which are currently in use. However, there are strong indications that these issues are a product of their age and the knowledge available at the time. More recent documents are more supportive of both risk management and planning for climate change. However, it is possible that this transition owes more to a lack of further opportunity in hard defence, influenced by climbing costs and a lack of viable projects than an innate desire to shift towards this approach. White and Hass (1975), supports this stance as their work championed such an approach long before it gained international attention, a view supported by KI4.

While there has been significant discussion around increased government involvement in regional flood management nationally, this research indicates little support for more significant central government involvement. The regions of New Zealand differ significantly and face a range of different issues, including those around flooding. Because of this, any central government guidance would need to be broad in scope, which would, arguably, limit the effectiveness of such legislation and potentially undermine the achievements of local government over the last twelve years.

Historical settlement patterns appear to be a significant limiting factor concerning flood management. The location of major urban centres, combined with a reluctance of individuals to abandon such settlements, and significant capital investments, have led to an environment where the costs of flooding are unlikely to decline due to the reluctance of people to leave at-risk areas. This situation raises questions about the long-term success of the risk-based approach in New Zealand, although the issue is one that is more likely to be determined by the economic costs than personal desire.

7 CONCLUSION

7.1 SUMMARY

Initially, this research sought to determine the degree of difference between rural and urban residents, and compare them to professionals in their understanding of flooding and their general flood awareness. The research has resulted in the collection of a range of data that has revealed some surprising results. It draws on a methodological approach that utilised both semi-structured interviews across a broad range of individuals considered relevant to flood management and an analysis of relevant district and regional plans using four components, considered best practice, derived from Ministry for the Environment publications. These were used to answer the research questions that were formulated to shape and direct this research.

The data revealed that flooding and its management is a complex topic, drawing on numerous disciplines and marred by a range of complicating problems that are not easily solved. Issues such as historical settlement patterns, land clearance and soil erosion were all raised, as well as more general sociological issues such as the tendency for people to ignore flooding risk, without being personally affected, and to forget about the impact of flooding after seven to eight years. All of this culminates in a setting where it is difficult to isolate flooding from other factors. Flood management then needs to be seen as part of a broader discourse on environmental management. This research, for example, has indicated that soil management is closely related to flooding. As a result, changes to the use and management of land will be essential to the overall success of flood management systems in the future. Changes are primarily needed if there is an increase in the overall number and frequency of flood events in the next twenty years.

Climate change and uncertainties around data collection are a major concern and are a complicate effective planning. Despite efforts made by regional and district councils, there is a lack of accurate data around what the climate will look like in the medium to long-term, this has significant limiting factors for flood planning. Additionally, the difficulties in communicating science and risk further complicate this uncertainty. For example, lay people typically lack the background and theoretical knowledge to understand the complexities of topics such as risk and flooding. Due to the nature of flooding, the hazard is not considered by a layperson until during or following an event, which leads to an emotional component which further complicates communication around the topic. Consequently education around present and

future flooding is challenging to achieve, and typically is of little interest to laypeople, until flooding occurs.

Flood policy is influenced by the past, with prior policy and obligations informing the present. This pattern has resulted in a substantial mitigation presence in both of the regions studied. The result of this has been the settlement of flood prone-areas which local government is now obligated to protect, even in situations where abandonment of these settlements would be more beneficial, both in the interest of the wellbeing of citizens and from a financial and human resources perspective. These prior obligations to commitments made by previous regional administrations limit the effectiveness of these practices and contribute to the slow adoption of more risk-based management. Despite this, new development shows definite signs of improvement. Secondly, it is likely that adoption of risk-based management will improve over time.

Resources remain the major limiting factor, exacerbated by the need for a local focus due to the unique nature of the regions and their needs. The staff size of many councils has also meant that they lack the financial resources that the central government can bring to bear. Solutions to this will likely be in the form of changes to the funding system of flood defences, as the increase in natural hazards will likely lead to a reduction in the willingness of the central government to subsidise the recovery of regions due to increasing costs. A second major limiting factor in the case of resources are staff, particularly those with an appropriate background in the science that is required to manage rivers and flooding effectively. Again, the solution to this will likely come from adopting new funding models that facilitate improved spending patterns.

7.2 COMMENTS ON THE RESEARCH

The research has identified several threads linked to flood management in New Zealand. Of these, there are four primary threads, with multiple sub-threads. These threads, policy, communication, resources and environmental knowledge all contribute to a system that can efficiently manage flood events. The research found that it was these four themes that played the largest part in flood management and influenced the way that it was enacted and, ultimately, its success. Overall the nature of flooding, as well as the interdisciplinary nature of flood management and research has led to the creation of an immense topic that is made up of numerous components, including sociological factors as well as policy and environmental science.

While there has been a discussion around developing a series of national policy guidelines in which to shape flood policy across the country, based on the data collected during this research, Informants felt such an approach would be counter-intuitive. In the absence of such a document, regions have been free to develop their policy and chose the direction in which the region moves. Introducing such a policy at this stage runs the risk of undermining this work, and in some cases, potentially requiring the rewriting of numerous policies to bring them into compliance with the National Policy Statement. While such a document would have had a positive impact a decade ago, at this stage the complications that it would likely cause are far more than any benefits it may bring.

This resistance to additional national guidance is reflective of the fact that different regions, encompass different catchments which in turn leads to different behaviours in their river systems. As a result, there is no one standard system off which to base a national policy. Additionally, each region differs in its settlement patterns and behaviours; districts, such as the Manawatu, which are primarily rural, experience different flood impacts than regions such as Auckland, or Dunedin. Flooding in areas such as South Dunedin result in different experiences than flooding in a small town such as Fielding. While the impacts of flooding on farms differ radically from flooding that affects urban areas.

What this illustrates is that effective flood policy and management is likely to occur when regions are allowed to determine the most effective way of managing the environment around them. While there are many complicating issues around flooding, land use and historic policy are the two most significant this method would allow for sufficient room to shape policy to ensure that it can account for local variations. Resources remain an issue in this scenario. However, it is an issue to which there are solutions, and a concentrated effort to educate people about flooding and risk would likely lead to reduced hard costs in the long term due to the adoption of practices tied to reducing exposure and leading to lower recovery costs.

Social capacity building is severally underutilised currently. In the future, it makes sense to attempt to cultivate social capacity building as one of the foundations of future policy as it provides benefits both before and after events, which aligns well with the increased uncertainty that a changing climate will lead to around both flood frequency and intensity in the future. Similar efforts have seen success in the Bay Of Plenty, and there is potential to expand this beyond the region.

7.3 FUTURE RESEARCH

This thesis has been successful in its primary aim which was to investigate differences in how people living in rural communities viewed flooding when compared to those living in urban settings. The secondary aims, which aimed to investigate differences between lay people and professionals in fields related to flood management has also been successful in investigating these differences, as well as the current and future shape of flood policy and what influences decision makers. Due to the complexity and size of the topic, there are several directions that future research could develop. Based on comments made by Key Informants during the data collection period, it seems that the interaction between flood management, property rights, and social bonds offer significant avenues of research.

While the data failed to show a link between flood awareness and rural and urban living divisions, there are opportunities to investigate the degree to which home ownership influences flood awareness. Such research may go some way to establishing a difference in the way that rural communities treat flooding when compared to urban communities. Questions around home ownership, or the extent to which having a long-term interest in the land, encourages behaviours that promote flood awareness and resilience. To this end, a dedicated project exploring attitudes to flooding between these two groups would be the logical follow-on to the present research, with a split made between those who have experienced flooding compared to those who have not.

The second avenue of further research would investigate the degree to which the presence of immediate family in the immediate area, particularly children, have on hazard preparation This would add to the potential direction discussed above and provides opportunities to explore the relationship of the family unit in regard to disaster preparation.

Finally, the research has revealed a close relationship between flood management and that of soil management. While the topic of soil erosion and its management is an area of increasing focus in both the public and private sector, there is scope for dedicated research into the relationship between current flooding trends and soil erosion, particularly in the hill regions of New Zealand.

7.4 FINAL REMARK

Flood management remains a complex and difficult topic, globally and within New Zealand. This research has illustrated some of the difficulties which New Zealand faces concerning creating a robust and effective management system that can account for the variety of factors that influence current and future approaches to flooding.

In the long term, a strong commitment to focusing on risk-based management will likely lead to lower costs and efficient distribution of resources. Such an approach will allow for more robust management. However, the uncertainties of climate change make the effectiveness of future policy difficult to predict.

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APPENDICES

APPENDIX A: KEY INFORMANT POSITIONS

Key Informant	Role/ Position of Informant
Key Informant 1	Surveyor
Key Informant 2	Insurance Agent
Key Informant 3	Real-estate Agent
Key Informant 4	Engineer
Key Informant 5	Regional Council Figure
Key Informant 6	Famer
Key Informant 7	Former Farmer
Key Informant 8	Engineer
Key Informant 9	District Council Figure
Key Informant 10	Regional Council Figure
Key Informant 11	Regional Council Figure
Key Informant 12	Academic
Key Informant 13	Member of Parliament
Key Informant 14	Former Catchment Board member
Key Informant 15	Farmer
Key Informant 16	District Council Figure

APPENDIX B: CODES USED IN ANALYSIS (MAJOR THEMES IN BOLD)

Code
Communication
Knowledge/ Understanding
Resources
Policy
Flood Response
Social/ Economic Factors
Flood Defences

APPENDIX C: PARTICIPANT INFORMATION SHEET



Rural and Urban Flooding Policy **INFORMATION SHEET FOR PARTICIPANTS**

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

What is the Aim of the Project?

This project is being undertaken as a requirement for the completion of a Master of Planning degree at the University of Otago. My research aims to investigate current policy around flooding, both in urban and rural settings. Additionally, it seeks to gauge opinion about what makes policy effective and the impact that a shift towards risk based hazard planning may have on future policy.

What Types of Participants are being sought?

The research seeks to gather the perspectives of key stakeholders involved in the flood management, both in policy and the effects that flooding has on people and places. This means the perspectives of council workers, planners, engineers, insurance and real estate agents as well as those involved in agriculture are all equally valued.

What will Participants be asked to do?

Should you agree to take part in this project, you will be asked to participate in a semi-structured interview. During the course of the interview, questions relating to managing flooding hazards and experiences with flooding will be asked of participants. The interview is expected to take no longer than 30 minutes. If at any stage you feel uncomfortable, you may decline to answer any question, or request that the interview be terminated. The information gathered from the research will be available to participants on request.

Please be aware that you may decide not to take part in the project without any disadvantage to yourself.

What Data or Information will be collected and what use will be made of it?

The data collected will be based on your professional knowledge and opinions, and will be obtained through a series of open-ended questions. No personal details or commercially or politically sensitive detail are sought. The interviews will be audio taped (where permitted) and transcribed as appropriate at a later stage. Only those directly involved in completing the research and their supervisor will have access to the audio recordings and transcriptions. The data will be used to inform the completion of an independent thesis to be published in order to complete a Master's degree in Planning.

The data collected will be securely stored in such a way that only those mentioned below will be able to gain access to it.

The results of the project may be published but every attempt will be made to preserve your anonymity.

This project involves an open-questioning technique. The general line of questioning relates to flood management, policy and the future direction it will take. The precise nature of the questions that will be asked has not been determined in advance, but will depend on the way in which the interview develops. Consequently, although the Department of Geography is aware of the general areas to be explored in the interview, the Department has not been able to review the precise questions to be used. In the event that the line of questioning develops in such a way that you feel hesitant or uncomfortable you are reminded of your right to decline to answer any particular question(s).

The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve your anonymity.

Can Participants change their mind and withdraw from the project?

You may withdraw from participation in the project at any time before the interview and up to two weeks following the interview without any disadvantage to yourself.

What if Participants have any Questions?

If you have any questions about our project, either now or in the future, please feel free to contact either:-

Oliver Hermans
Department of Geography
Email Address: herol728@student.otago.ac.nz

and

Michelle Thompson-Fawcett
Department of Geography
Email Address: mtf@otago.ac.nz

This study has been approved by the Department stated above. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

APPENDIX E: PROVISIONAL INTERVIEW QUESTIONS

1. What is the current state of flood management policy? – and how effective is it?
2. What key factors drive flood policy in the area? – is this likely to change in the future?
3. How does the community view flooding? Has there been a change from how it was viewed in the past?
4. Are there some key fundamentals you feel need to be preserved in policy?
5. What major impacts does flooding have on the area specifically?
6. Do you think that risk based assessment is a better answer to current and future land use demands in flood prone areas?
7. Is there a wide difference in how you view flooding compared to if you were a lay person/ expert?
8. If you lived in town/ the country do you think you would have different views about what the biggest impact flooding has?
9. Which organisations and individuals would you say are critical to flood hazard management in the region/ area?
10. What is the current level of protection in the area, both here and throughout the region, does it differ depending on if it is rural or urban?
11. What kind of changes do increased land use and climate change mean for the flood risk that regions are exposed to?
12. What extra mitigation methods may be required?
13. Are the currently available tools being used as effectively as they could be?
14. Does better integration of river control with urban storm and water management offer potential for better overall management?
15. Do you have any thoughts on how relevant authorities could be better integrated to deal with these issues more effectively?
16. How can councils better deal with flood management
17. Is there a role for the central government in terms of funding some of these regional and district projects?
18. Is legislation consistent in terms of what it is trying to achieve?
19. Is it easy to begin and approach new programmes and ideas?
20. How can the risks and issues around natural hazards be better communicated, both to professionals and lay people.

21. Should the government be legislating and pushing for minimum levels in terms of flood protection.