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Local government adapting to climate change: Managing infrastructure, protecting resources, & supporting communities

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Climate change presents risks to a number of local government functions, including water supply, wastewater treatment and disposal, transportation, flood and coastal management, waste collection, recycling, management and disposal, providing and maintaining social infrastructure, civil defence responsibilities, and community support.

Projections of the likely climate change impacts for New Zealand enable local government to undertake risk assessments to an appropriate level across their range of services, allowing them to focus on areas of high risk. Once key risk management areas have been identified, local government has a legislative mandate to undertake both adaptation and mitigation as well as requiring others to manage these risks. Incorporating adaptation measures into plans can also present opportunities for long-term community benefits.

Key Resource Management Act related instruments which seek to increase national and regional integration, and hence have the potential to greatly assist local government with implementation of adaptation planning, are National Environmental Standards, National Policy Statements and Regional Policy Statements.

The communication requirements to engender the changes required should not be underestimated. Innovative approaches to communicating sustainable development and climate change adaptation messages should be used by councils seeking to work through changes that may significantly affect communities in their regions. A number of excellent local and international case studies demonstrating climate change adaptation are available giving insight into the adaptation risks and requirements for council decision makers and communities.

1. Introduction

This paper discusses a range of issues relating to local government, the effects of climate change on the communities they support and the infrastructure they manage. It focuses on opportunities to promote adaptations to avoid or mitigate significant negative impacts on the natural environment, and on communities and the infrastructure they depend on. It also identifies potential barriers to the adoption of these approaches.

Adaptation measures to protect communities from flooding, coastal inundation, water resource availability risks or other climate related hazards are already commonly in place. Risk management, hazard management, low impact urban design, energy saving, water efficient design, community resilience and other terms are in common use to describe these adaptation measures. All of these approaches can be central to, or assist with, climate change adaptation.

We define local government or local authorities as regional councils, district and city councils and unitary authorities. As the effects of climate change are likely to impact on all infrastructure that local government is responsible for, including transportation, this paper should also be of interest to national infrastructure providers such as the New Zealand Transport Agency (NZTA), Transpower and the New Zealand Railways Corporation (NZRC).

The legislative framework for local government management of infrastructure and natural resources is interpreted for climate change adaptation, highlighting opportunities and risks.

There are a number of local government functions that have the potential to be significantly influenced by climate change. These include:

- policy and plan making
- infrastructure provision
- resource management and allocation
- community services provision.

The risks, challenges and opportunities associated with effects of climate change are outlined here. The necessity for prudent development and use of legislative and policy instruments is discussed. The final sections of this paper relate to the human aspects of communication about climate change. We present some ideas and insights into effective communication about complex and sometimes uncertain science and impact assessment that may help us to collaborate with communities.

2. Local government functions

Many of the functions of local government relate to or can be affected by climate change. The Local Government Act 2002 (LGA), states that the main purpose is "...to promote the social, economic, environmental, and cultural well-being of communities, in the present and for the future." Inherently this requires councils to have policies and plans that include a view of the future encompassing climate change.

A core function of local government under the Resource Management Act 1991 (RMA) is the integrated management of natural and physical resources. This includes a requirement to plan for the future in managing the effects of land use, avoiding and mitigating natural hazards, and to have particular regard to the effects of climate change.

With the powers that local government holds in policy and plan-making comes the ability to approve and control both development by third parties and the development and maintenance of the councils' own infrastructure. Councils have responsibilities to ensure that their decision making in planning policy and zoning is based on defensible science, is transparent to stakeholders and is fairly administered. A good example is the case study of industrial land rezoning in Invercargill City (Case Study 1).

Case Study 1.

Industrial land rezoning programme, Invercargill City, 2008.

Invercargill City purchased 600 ha of land for industrial development following a site selection exercise. A change to the Invercargill District Plan was required to enable the land to be rezoned from rural use to industrial use. During the process the potential effects of climate change were raised by Environment Southland. Invercargill City was required to identify and quantify as far as possible the long-term effects of sea level rise, the impacts of changes of storm patterns on coastal processes, and changes in stormwater runoff patterns resulting from changes in rainfall intensity/duration.

The studies confirmed that the site was suitable for industrial development, but required a more extensive coastal buffer and greater setback conditions from flood prone areas. Once these amendments were made to the planned change for rezoning, Environment Southland withdrew its submission in opposition to the change. The rezoning process required technical inputs on climate change impacts and demonstrated the need for best possible information. It also highlighted the effectiveness of a risk-based approach and the desirability of consultation with key stakeholders early in the planning process.

Councils are responsible for many functions which provide support for their local communities, all of which may be affected by climate change. These include:

- constructing and managing roads
- water supply and water resource management
- water and wastewater treatment and disposal
- waste collection, recycling, management and disposal
- providing and maintaining social infrastructure, including recreation and leisure facilities
- civil defence responsibilities
- community support and outreach.

Councils will also often be the first port of call for individuals or community groups seeking information and advice on climate change impacts.

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3. Future risks from climate change

A summary (MfE 2008a) of the report originally commissioned by the Ministry for Environment (MfE), 'Climate Change Effects and Impacts Assessment (2nd ed)' (MfE 2008b) outlines the following broad climate change projections for New Zealand:

- an increase in the average temperature and sea levels
- southern and western areas generally becoming wetter
- eastern and northern areas generally becoming drier
- an increase in drought frequency, particularly in the eastern parts of the South Island and central North Island, and
- a likely increase in the occurrence of extreme storm events.

Some of the projected changes to New Zealand's climate may lead to the exacerbation of weather related hazards, such as flooding, coastal inundation, rainfall-induced landslides and potable water security. With increased flooding risk, for example, comes increased chance of loss of life, damage to property, landslides affecting property and infrastructure and the potential for loss of productive soils. The 2004, 1 in 100-year, floods in the Manawatu were estimated to cost \$150 million. There is potential for 1 in 100-year events to occur more frequently in the future with clear consequences for the associated costs of disasters.

It is no longer acceptable for local government to base projections for the future on the lessons of the past. Predictive models that take into account the latest projections of climate change from the Intergovernmental Panel on Climate Change (IPCC) integrated with more local knowledge are required. The National Institute of Water and Atmospheric Research (NIWA) has updated the High Intensity Rainfall Design System (HIRDS) database for prediction of storm intensity, for example, and similar expert knowledge should be sought by local government where other meteorological, sea level or storm surge data are critical.

Many of the impacts of climate change are focused on the coastal environment and include significant consequences for coastal property and infrastructure due to storm surge, erosion and saltwater intrusion. In addition there are likely to be impacts on the terrestrial habitats of the coastal zone which in some cases provide shoreline or estuarine protection.

There have been significant investments on the coast, with an estimated \$1 billion of real estate being situated in the Coromandel coastal hazard setback zone alone. This hazard zone was determined by the Thames Coromandel District Council (TCDC) and incorporated in their district plan.

To assist local government in selecting an appropriate sea level rise projection to plan for, MfE is currently scoping the development of a National Environmental Standard (NES) on future sea level rise. The NES prescribes a base threshold of future sea level rise to plan for, along with requiring consideration of the consequences of a higher sea level rise. For planning and decision timeframes out to 2090-99 a base value sea level rise of 0.5 m relative to the 1980-99 average will be used. The potential consequences of a range of possible higher sea level rise values will also be assessed. At the very least, all assessments will consider the consequences of a mean sea level rise of at least 0.8 m relative to the 1980-99 average (MfE 2009).

National Environmental Standards are regulations issued under the RMA. They apply nationally and all councils must enforce them. The development of an NES with a prescribed sea level rise will be of significant assistance to local government because it will remove the risk of litigation as councils will not have to determine for themselves appropriate levels to be adopted in regional and district plans.

As changes can be made to NES's, future sea level rise projections can be amended if necessary to reflect the best available information.

3.1 Assessing climate change risks

MfE (2008a) described a pragmatic approach for local government in deciding how to assess climate change risks. The guide describes three stages in risk assessment tailored to be cost and time effective. An overview of the assessment is presented below.

3.1.1 Stage One: Qualitative assessment of the influence on climate change

The first stage is a qualitative assessment of the role of climate and hence climate change for a wide range of council functions and services. Functions are tabulated with narrative on affected assets or activities, key climate influences and possible effects. Reference is also made to natural resources, the key climate influences on that resource, impacts of climate change and their sensitivity. Examples are presented in Tables 1 and 2.

After the high level assessment of climate change impacts on council services a decision is required as to whether the impact warrants a stage two, quantitative, analysis. Asset management driven assessments are most likely during major infrastructure development or upgrades. Council plan reviews will also warrant further assessments.

Table 1. Local government functions and possible climate change outcomes (extracted from MfE 2008a).

Function	Affected assets or activities	Key climate influences	Possible effects	Type / Explanation of effects (See Table 2)
Water supply and irrigation	Infrastructure	Reduced rainfall, extreme rainfall events and increased temperature	Reduced security of supply (depending on water source) Contamination of water supply	Rivers Groundwater Water availability Coastal areas
Roading	Road networks and associated infrastructure (power, telecoms, drainage)	Extreme rainfall events, extreme winds, high temperatures	Disruption due to flooding, landslides, fallen trees, and lines Direct effects of wind exposure on heavy vehicles Melting of tar	Drainage Natural hazards

Table 2. Sensitivity of natural resources to present climate and climate change (extracted from MfE 2008a).

Natural resource	Key climate influence	Impacts of climate change	Present sensitivity to climate
Rivers	Rainfall	River flows likely to, on average, increase in the west and decrease in the east of New Zealand More intense precipitation events would increase flooding (by 2070 this could be from no change up to a fourfold increase in the frequency of heavy rain events)	Strong seasonal, interannual and interdecadal fluctuations
Drainage	Rainfall	Increased frequency of intense rainfall events could occur throughout New Zealand, which would lead to increased surface flooding and stormwater flows, and increased frequency of groundwater level changes	Natural year-to-year variation in the location and size of heavy rainfall events

3.1.2 Stage Two: Preliminary assessment of the impact of climate change

Due to the uncertainties regarding the extent of climate change, various scenarios can be useful in the preliminary assessment of the impacts of climate change. MfE (2008a) recommends three broad categories of scenario.

- 1) Social: Demographic changes leading to changes in demand and supply of council services and natural resource requirements
- 2) Economic: Changes in land use which affect demand and supply of natural resources
- 3) Physical/environmental: Projected future climate change

The report summary also provides some basic data on temperature projections and rainfall intensity projections that can be used by local authorities.

For rainfall predictions MfE recommends using HIRDS (high intensity rainfall design system) from NIWA with percentage adjustments per degree of climate warming for different rainfall occurrence interval's and rainfall durations. For other climate impacts, such as crop growing degree days, frost occurrence, extreme high temperatures and water deficit for irrigation, the CLIMPACTS model is recommended (Warrick et al. 2001).

The preliminary assessment of impacts based on quantitative climate data should focus on categorisation of the magnitude of risks to infrastructure, development, communities and property.

Where these impacts are significant, the investment in a full risk assessment is justified.

3.1.3 Stage Three: Detailed risk assessment of climate change effects using complex scenarios

Detailed risk assessments can be undertaken in three main ways as set out below, and often rely on combinations of these for a final assessment or likely range of outcomes.

- Modelling, computer-generated scenarios
- Expert opinion, often required where there is a lack of data or data certainty
- Monitoring, will assist in providing assurance about modelled scenarios over time or provide data for modelling or verification of expert opinion

The decision on which approach to take will be based on the availability of verified data and modelling capability, and assumptions will need to be made regardless of which approach is taken.

Case Study 2 is a recent example of the application of risk methods to climate change impacts assessment on infrastructure.

Case Study 2.

New Zealand Transport Authority (NZTA) research, climate change risks to the land transport network.

The New Zealand Transport Authority (NZTA) commissioned MWH and NIWA to research climate change risks to the land transport networks (state highways, railways, ports and coastal shipping) (Gardiner et al. 2009a, 2009b).

Stage One involved identifying the state of knowledge and prioritising further research for Stage Two. The extensive Stage One review involved stakeholder interviews, reviews of literature, climate change data, and legislation and policy issues, and gap analysis. It also included a risk assessment to identify and prioritise the dominant risks to road, rail and ports/coastal shipping. The results of this risk prioritisation are presented below (Gardiner et al. 2009a).

In summary, the top priority risks relate to:

- coastal inundation from sea level rise combined with storm surge (ports but also coastal land transport corridors potentially at risk)
- inland flooding (all modes)
- high rainfall and inland erosion/instability (road and rail)
- prolonged high temperatures (heat stress leading to rail buckling in particular).

√√√ = Top priority √√ = High priority

Stage Two (Gardiner et al. 2009b) examined the regional effects of climate change on the physical infrastructure of land transport systems with a focus on:

- temporal and spatial distribution of significant climate change effects
- which parts of the surface transport networks are most at risk
- multimodal corridors at risk (e.g., common road/rail routes)
- when these risks may emerge
- what priority adaptation responses are needed to counter these effects.

A national risk profiling approach was developed to determine the likely regional effects of three high priority risks to the national land transport networks:

- heat stress (buckling) affecting the national rail network as a result of high temperatures
- inundation of low-lying coastal land transport infrastructure (road and rail) caused by sea level rise and storm surge (including a port risk profile study)
- future flood risk under climate change for sections of the state highway and rail networks that are currently prone to flooding.

Scenarios were developed for current (nominally 10-year) and future (50-year and 100-year) timeframes and regional impacts for each mode were illustrated using GIS maps that overlay climate change predictions and transport infrastructure.

Climate change effect category	Risk	Additional factors	Priority
Coastal flooding (sea level rise and storm surge)	High risk to all three modes	<ul style="list-style-type: none"> • Top five risk to coastal shipping ('top five' as per the risk prioritisation exercise) • Only some coastal locations affected • Significant costs likely for response options • Particularly important for assets with a long design life 	√√√
Inland flooding	High risk to all three modes	<ul style="list-style-type: none"> • Top five risk to road • Significant costs likely for reinstatement or rebuilding • Particularly important for assets with a long design life 	√√√
Rainfall	High risk to road and rail	<ul style="list-style-type: none"> • Top five risk to road and rail • Significant costs likely for reinstatement or rebuilding • Particularly important for assets with a long design life 	√√√
Inland erosion and instability	High risk to road and rail	<ul style="list-style-type: none"> • Top five risk to road and rail • Significant costs likely for reinstatement or rebuilding 	√√√
High temperature	High risk to rail	<ul style="list-style-type: none"> • Top five risk to rail • Rail has a long design life • Forward planning is required to allow stage replacement of at-risk rail, and to ensure new designs are adequate 	√√√
Storminess	High risk to all three modes	<ul style="list-style-type: none"> • Aggregate effects (extreme rainfall and high winds) are top risks for all modes and recommended priorities to progress • Potentially widespread distribution of effects 	√√
Coastal erosion	High risk to road and coastal shipping	<ul style="list-style-type: none"> • Not a top five risk • Only some coastal locations affected • Significant costs likely for response options • Particularly important for assets with a long design life 	√√
High winds	High risk to road and coastal shipping	<ul style="list-style-type: none"> • Top five risk to coastal shipping • Most high risks can be mitigated at short notice; however, protecting ports may be difficult 	√√

4. Legislative framework

Key legislation that provides local government with the powers and responsibilities to manage the risks associated with climate change and consider climate change adaptation are:

- The Resource Management Act 1991 (RMA)
- Local Government Act 2002 (LGA)
- Building Act 2004
- Civil Defence Emergency Management Act 2002 (CDEMA).

4.1 Resource Management Act 1991

With its overarching emphasis on sustainable management, future generations, and avoiding, remedying and mitigating effects the RMA forms a backbone for local government in addressing the risks arising from climate change. Part 2 of the RMA is of critical importance and sets out its principles and purpose, in particular to “Promote the sustainable management of natural and physical resources”. The principles of the RMA also require that RMA decision makers have particular regard to the effects of climate change.

An interesting aspect of the RMA is the categorisation given to effects (not just those related to climate change):

- past and future effects
- cumulative effects
- potential effects of high probability
- potential effects of low probability that have high potential impact.

The RMA is implemented through a hierarchy of planning instruments:

- National Policy Statements
- National Environmental Standards
- Regional Policy Statements
- Regional Plans
- District Plans.

This hierarchy is designed to achieve national alignment on matters of national significance such as climate change while ensuring the decision making is devolved to those most affected.

Other provisions in the RMA relating to climate change responsibilities include the requirement for councils to gather information, undertake monitoring and keep records including those of natural hazards, and that decision making be undertaken with regard to this information.

An essential element of planning for climate change adaptation is the integration of decision making relating to land use planning and resource allocation locally, regionally and nationally. RMA mechanisms, strengthened in the 2009 amendments, include the ability for councils in a region to come together and produce a combined plan that includes a regional policy statement, regional plans and district plans.

This mechanism provides the opportunity for a region to undertake fully integrated planning approaches, particularly in addressing significant cross-boundary issues such as climate change adaptation. However, strong support and commitment will be required from local government politicians to take full advantage of the opportunities for integrated planning provided for under these new provisions.

4.2 Local Government Act 2002

The Local Government Act (LGA) 2002 also adopts a sustainability approach but refers to sustainable development specifically rather than “sustainable management” as in the RMA. Section 3 of the LGA states that “the Purpose of this Act is to provide for the democratic and effective local government that recognises the diversity of New Zealand communities; and, to that end this Act... (d) provides for local authorities to play a broad role in promoting the social, economic, environmental and cultural well-being of their communities, taking a sustainable development approach.”

Further to the purpose of the Act, section 14(1) states “in performing its role, a local authority must act in accordance with the following principles... (h) in taking a sustainable development approach.

A local authority should take into account:

- i. the social, economic, and cultural well-being of people and communities; and
- ii. the need to maintain and enhance the quality of the environment; and
- iii. the reasonably foreseeable needs of future generations.”

The requirement under the LGA to reasonably foresee the needs of future generations with the aim of ensuring community well-being and maintaining and enhancing the quality of the environment places a firm requirement on local government to develop, understand, communicate and manage, risks associated with climate change in their regions, districts and cities. The key instrument, required by LGA for developing the approach and communicating the message is the ten year long-term council community plan (LTCCP). The main tool for addressing risk management for key council assets is an Activity Management Plan. Owners of LTCCP and Activity Management Plans can and should include climate change risks in the review of these documents on an ongoing basis using up to date projections of change.

The LGA provides local government with a mandate to investigate the risks in their regions, districts and cities, to provide for the means and mechanisms to address these risks through the LTCCP and incorporate climate change risk management into Activity Management Plans.

4.3 Building Act 2004

The Building Act also includes sustainability in its core purpose, ensuring that “buildings are designed, constructed, and able to be used in ways that promote sustainable development” (section 3(d)).

The Building Code, along with the responsibility of city and district councils to enforce the Code, provides the strongest opportunity under the Act to ensure that buildings are completed to the required standards while taking into account the latest meteorological predictions. Of particular significance is Clause B1 of the Building Code which requires physical conditions that could affect structural stability, including snow and wind loads to be taken into account in building design. Also of importance is Clause E1 which deals with surface water.

In terms of new building codes, data from NIWA, the Building Research Association of New Zealand (BRANZ) and the local authorities should be interpreted together so that appropriate decisions can be made on climate change adaptation. Active communication between building consent and resource consent divisions in councils is essential to ensure consistency of approach for developers and the community. This integration is critical for the provision of up-to-date information

for project information memoranda where there is a requirement to disclose information on special features of the property concerned, including natural hazards. Under section 71 of the Building Act, a building consent cannot be granted if the land is subject to natural hazards such as erosion (including coastal erosion) or inundation (including flooding, overland flow, storm surge, and tidal effects).

4.4 Civil Defence Emergency Management Act 2002

There are several requirements for local authorities under the Civil Defence Emergency Management Act 2002 (CDEMA). The Ministry of Civil Defence and Emergency Management (CDEM 2002) lists these as the following.

- Unite with your regional neighbours and emergency services to form a Civil Defence and Emergency Management (CDEM) Group
- Develop a coordinated CDEM Group plan for how your Group manages its hazards
- Plan and provide for CDEM in your district
- Ensure you are able to function to the fullest possible extent during and after an emergency

A local authority may also be requested to:

- help define the Crown's CDEM goals and objectives in a National CDEM Strategy
- participate in developing a National CDEM Plan
- provide technical advice on CDEM issues to the Director of Civil Defence Emergency Management or another CDEM Group.

There are expectations that the local authority will:

- coordinate, through the CDEM Group, planning and activities related to CDEM in risk reduction, readiness, response, and recovery
- develop plans cooperatively with others
- ensure individual functions (business units) are capable of managing their own response to emergencies to the fullest possible extent
- ensure business units coordinate across their respective sectors.

The process of planned community adaptation to climate change with hazard information being regularly updated should reduce the likelihood of a local authority needing to invoke a civil emergency.

4.5 Health Act 1956

The Health Act 1956 includes a requirement for city and district councils to protect and promote public health and to determine if conditions exist that are likely to be injurious to health. If such conditions do exist, councils are required to take reasonable steps to ensure they are abated or removed. These requirements can include emerging threats to public health associated with climate change (Howden-Chapman et al. 2010).

5. Infrastructure

Local government, and in some cases its subsidiaries, has major responsibilities in the planning, development, operation and maintenance of critical infrastructure for towns, cities, districts and regions. Required activities include:

- securing water sources for municipal supply, and the treatment of that water to potable standards for supply to homes, businesses, etc.
- management of stormwater runoff from roads and urban areas
- provision of safe sanitation, sewage collection, treatment and disposal
- collecting solid waste, recycling and operating landfills
- management of all roads other than state highways, and other infrastructure located in road reserve such as power, gas, and telecommunications
- flood management (stopbanks, ponding areas, pumping stations, etc.).

Some infrastructure, particularly infrastructure located in vulnerable locations such as the coast, riverbanks, and flood plains, will be at risk from climate change. For example, many of our towns and cities discharge treated wastewater into the coastal environment, and as a consequence many wastewater treatment plants are located on the edge of harbours and estuaries and are at risk of inundation by sea level rise and/or storm surges.

Intake structures for municipal water supply in the banks of rivers and streams may also require assessment. During the 2007-08 Waikato droughts a number of councils became very concerned that river levels would drop below the level of the intake structure, putting at risk the security of water supplies.

Case Study 3 presents an example for stormwater disposal from the Indoor Community Sports Centre (ICSC), in Kilbirnie, Wellington.

Case Study 3.

Indoor Community Sports Centre (ICSC) Stadium, Kilbirnie, Wellington City Council.

Modelling and reviewing future stormwater scenarios resulted in climate change being considered in the design and planning procedures for the ICSC Stadium. The proposed stormwater disposal options involved either direct disposal into Wellington Harbour or connecting to the Wellington City stormwater system. The first option involved crossing a major highway. The second option required upgrading of the stormwater network.

The Wellington City Council used the opportunity this project presented to review climate change impacts on the stormwater management plans for the whole of Kilbirnie. Following the review and updating of the stormwater models, the preferred solution was stormwater pumping to the harbour from the two major stormwater outlet pipes. The study highlighted serious impacts from climate change and sea level rise on "levels of service" for low lying coastal stormwater networks and that stormwater pumping is a likely outcome of such assessments in the future.

Many councils are seeking efficiencies and innovation in their approaches to providing and managing infrastructure. Such approaches can have multiple benefits, including climate change adaptation. A good example of this is the work councils are undertaking with the integration of the three urban waters (stormwater, potable water, and wastewater) and the adoption of green technologies. A research project undertaken over the past few years led by Landcare Research and the University of Auckland entitled Low Impact Urban Design and Development (LIUDD) has investigated practices, practicalities, opportunities and barriers to implementation of green design for stormwater management in urban areas. The research project web-portal¹ contains a wealth of information and a wide range of case studies.

6. Challenges for local government

Local governments face many challenges in delivering their infrastructure responsibilities, including the following.

- **Access to reliable and relevant data.** All infrastructure design and development works must be based on local information that needs to be collected, managed and applied, especially if councils are adopting regulatory approaches. There can be significant costs associated with obtaining and verifying this information along with the political commitment to provide the necessary funding. There are also technical challenges in the type of data and the level of detail required.
- **Climate change will impact on different councils in different ways.** Different councils will have different climate change impacts and adaptation requirements. 'One size will not fit all' in adaptation approaches. The 'Urban Impacts of Climate Change Toolbox' currently being developed by NIWA, MWH, GNS Science and BRANZ will provide multiple assessment and adaptation options that can be designed to provide individual council needs and resources (NIWA et al. in progress).
- **Challenges in translating the big picture to regional and local levels.** There is evidence that communities see climate change as a global issue for which central government is responsible. Councils need to make people aware that it is a local issue, particularly in terms of climate change adaptation. Councils have a responsibility to provide local information and tools for adaptation to empower communities to make choices and take action.
- **Need to manage political risks and get councillor 'buy-in' and support.** This can be challenging given the short-term three year electoral cycle and the long term investment required for climate change adaptation. Anecdotal evidence suggests that many councillors, and regional councillors in particular, question the need to plan for managing the effects of climate change and adopting adaptation measures. It is a case of the costs come now, but the benefits are long-term – this can be a hard message to sell, especially with councillors who have been elected on a no rates increase platform.

Local government has faced, and will continue to face, significant challenges when adopting regulatory methods that restrict how people use and develop their properties. Introducing such restrictions through district and regional plan changes and reviews can lead to expensive and protracted litigation due to concerns about loss of property values and restrictions on resource use and allocation.

Local government has also come under increasing pressure from landowners to carry out works to protect properties threatened by natural hazards such as sea inundation, storm surges and flooding. It is anticipated that these pressures will only increase where such hazards are exacerbated through the effects of climate change. This raises the contentious issue for local government and its communities as to whether and to what extent it is appropriate to use ratepayer money to protect private property. There is also concern that some of the smaller councils do not have the resources to act and respond because of their limited rating base.

The ability and agility of councils to respond to climate change through the planning process is hampered by New Zealand's cumbersome plan-making processes. If councils need to act quickly in adapting to climate change, then making changes to district and regional plans may not deliver a quick result. From start to finish, to change a plan takes about 3 years, and to review an entire plan takes, on average, over 8 years. Government has attempted to address this significant issue through the Resource Management (Simplifying and Streamlining) Amendment Act 2009, but the changes made to the plan-making provisions fall far short of addressing this challenging and complex issue.

District and regional plans do, however, provide longer term, strategic opportunities to bring about land use changes and changes to urban form to assist with climate change adaptation.

Councils in their roles as consent authorities can also influence the location of activities, resource use and allocation to minimise the effects of, and risks associated with, climate change and to require measures to be undertaken to assist adaptation.

“ This raises the contentious issue for local government and its communities as to whether and to what extent it is appropriate to use ratepayer money to protect private property. ”

7. Opportunities – the way forward

There are many apparent challenges for New Zealand in adapting to climate change, but it seems that there is a will for change. The New Zealand Business Council for Sustainable Development (NZBCSD) and ShapeNZ undertook a survey in March 2009 investigating New Zealanders' attitudes to climate change. The survey polled 2851 individuals and presented the following findings (NZBCSD & Shape NZ 2009):

- 76% believe climate change is a problem
- 65% believe that there are already climate change effects
- 53% worry about climate change
- 44% believe personal lifestyles will be affected.

¹Available from: http://www.landcareresearch.co.nz/research/built/liudd/casestudies/case_studies.asp (accessed 11 January 2010)

These statistics support and reinforce the importance of local authorities communicating with and assisting their communities in adapting to a changing climate and to clearly articulate their expectations for their region, district or city. Ensuring that their policies and plans then reflect these expectations and that the necessary actions are taken to deliver desired outcomes is as important. Anecdotal evidence indicates that in some areas the concerns of the community regarding climate change may be ahead of any commitment and action by the local council. Where such change is grass roots-driven, councillors will be required by the communities they serve to undertake and commit to actions if they expect to be re-elected by that community.

While some local bodies may appear to be slow in responding, other councils are taking action to assist with climate change adaptation. These actions may have originally commenced for another purpose but are now being recognised for their multiple co-benefits, including those of adaptation.

An example of community adaptation by another name is the 'Living Streets' project in Christchurch. Living Streets employs holistic design methods for traffic calming, storm water management and treatment, and landscaping, and promotes bicycle and pedestrian access (Case Study 4). At the same time, these designs increase biodiversity, capture carbon, encourage people out of their cars and assist in reducing the impact of extremes of temperature. The project provides a multiplicity of social, environmental and economic benefits. More information can be found at the Case Study Portal of the Landcare Research-led LIUDD research programme².

That adaptation projects can have multiple benefits is a key message for council and community. Communication on changing climates, flooding and coastal hazards can easily be led by, or lead to, fear and subsequent lack of integrated and innovative thinking for solutions.

The insurance industry is providing support and placing pressure on local government to take adaptation actions by increasing premiums

or refusing to insure properties and businesses where there are potential climate change risks that are not being addressed by local government actions. In the United Kingdom insurers are producing guidelines for small businesses and the development industry on climate change adaptation. Similar approaches could be followed in New Zealand if the insurance industry considers that this type of information is required and is not being provided by local or central government.

8. Integrated approaches

Integration and coordination are keystone concepts in both the adaptation and mitigation of climate change, whether working at a global level through the United Nations or at a community level in rural New Zealand. Integration is required between levels of government and between the top down and bottom up development of issues, objectives and solutions. Integration is required between departments, disciplines, cultures and communities to build a holistic view of risks and opportunities, and to provide the most productive environment to encourage adaptation solutions.

Where there is an overlap of responsibilities, particularly with regional and city and district councils, it is important, that these are resolved and agreed upon. Regional councils are well placed to provide leadership and ensure integrated and consistent approaches. City and district councils are critical in implementing adaptation, but they need support from regional councils, ongoing commitment, and capabilities and the tools to be proactive and responsive.

As previously discussed, the 2009 amendments to the RMA provide additional opportunities for regional, district and city councils to prepare combined planning instruments. These new abilities provide an excellent opportunity to take an integrated approach to such significant issues as climate change. It will be interesting to see whether there is the political commitment along with incentives from central government to capitalise on these opportunities.

Case Study 4.

Addington streetscape, Christchurch City Council.

Addington is an old neighbourhood that is in need of revitalisation. A Neighbourhood Plan aims to "gradually renew the older residential areas of the city to standards appropriate to today". The kerb and channel renewal project for Addington involves traffic calming, street tree planting, creation of green space, opening up and restoring waterways, landscaping, provision of seats and installation of art features.

Christchurch City Council (CCC) undertook extensive public consultation, hosting community meetings and updating residents and interested parties on the projects in the community newsletter 'Addington Update'. The community was asked what they would like to see in their reconstructed street.

CCC's stormwater management policies promote the improvement of the quality of stormwater run-off before entering waterways. CCC's Waterways, Wetlands and Drainage Guide assists in ensuring that drainage is no longer the sole focus and that projects should be developed that integrate other values, including ecology, landscape,

recreation, heritage and culture. The guide encourages people to work with natural features and processes in the landscape.

Addington's unique, wide catchment, combined with anthropogenic issues influenced the approach to the stormwater management in this area. The quantity and quality of stormwater in Addington were the main drivers for CCC undertaking ecological enhancements of the waterways in the area.

CCC has installed a first flush pond, rain gardens and a vegetated swale. These are features designed to help with the ecological enhancement of Addington, and help to slow and filter stormwater run-off through vegetation and soils/sands. Pollutants are trapped and processed (through plant uptake) before they reach downstream waterways. The amount of impervious area has also been reduced following enhancement works.

The risk of flooding has also been reduced. Historically, during heavy rainfall events gutters cannot always cope and surface flooding can occur. First flush ponds, rain gardens and swales reduce the likelihood of flooding both in the immediate area and further downstream by providing greater drainage capacity and detaining stormwater run-off so that it discharges into waterways at a slower rate.

²Available from: <http://cs.synergiem.com/CaseStudies/tabid/73/Default.aspx> (accessed 11 January 2010)

9. Communicating the messages

A critical component of implementing climate change adaptation is communication and ensuring communities understand the message and have the tools to make choices and take action. Councils are likely to be the first port of call for their communities for information on climate change and guidance on adaptation. Local authorities in New Zealand should also consider recent research and experience in other countries when planning their communications strategies. Some useful communication messages have been developed by Futerra, a UK based communications organisation that promotes sustainability. Key messages include the following (Futerra, no date).

- **Keep it personal** – make climate change messages as personal as possible. Create climate messages about ‘my region, my town, my street, my house, my business’
- **Help people to help** – climate change communications can make people feel bad, irrelevant and useless. Help people to understand (and trust) that they are making a difference
- **Use fear with caution** – fear can create apathy if individuals do not have the ability and tools to act upon that fear
- **Give people the knowledge to decide and the tools to act** – change will occur when people know what to do, decide for themselves to do it, have access to infrastructure in which to act, and understand that their contribution is important
- **Link climate change adaptation to positive outcomes** – home improvement, saving money and resources, business opportunities, self-improvement, and green space, biodiversity, etc.
- **Seeing is believing** – climate change is language heavy, but light on visuals. Many climate change awareness programmes provide detailed scientific information and expect communities to understand and act on this information. Many people do not have the knowledge to understand graphs and figures, and raw scientific information is unlikely to be effective in motivating behavioural change. To have an effective impact, materials need to send clear messages in a manner that the audience will understand – “see it, feel it”, “see it, believe it”.

10. Conclusions

Actions relating to planning for and implementing adaptation to climate change are required across a wide range of local authority responsibilities and activities. There is both a legislative requirement for risk assessments and risk management to be undertaken and a mandate for local authorities to implement change and require others to change.

Some climate change risks are very significant. They include threats to homes, communities and critical infrastructure. These risks require political engagement and a commitment to manage. Sound planning and communication are essential for the development of acceptable and efficient adaptation and mitigation strategies. Sound decision-making should be based on good data for modelling, expert opinion from a wide range of disciplines, and careful integration of this data and opinion into planning processes and plan implementation.

There is clear evidence that planning processes and projects that include climate change adaptation will produce multiple benefits in the long term. It is essential that case studies of well planned and executed sustainable development projects which include climate change adaptation are shared nationally and internationally to motivate and inspire. There is great potential for local governments to work collaboratively and in partnership with each other and with central government to ensure that efficient and effective adaptation is implemented across New Zealand.

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