

Managing Flood Risk

The Case for Change

Sustainable Outcomes

National Economy
Communities
Catchments
Rivers and Streams

Floods

Water
Sediment
Nutrients
Pollutants
Debris

Risk Management

Strategies

River Control
Insurance
Landuse Control
Response Planning
Demographic Planning
Regulations and Codes

Responsibilities

Central Government
Local Government
Business
Communities
Individuals

Prepared for the Flood Risk Management Governance Group by The Centre for Advance Engineering, University of Canterbury, Christchurch.

The purpose of this report is to state the case for, and the likely elements of, an improved approach to flood risk management in New Zealand.

The report is offered now as an invitation to others to consider the need for and the proposed contents of the approach (called herein a *Protocol*). Inquiries and comments should be addressed to:

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Further copies of the report can be downloaded from the CAE website (www.caenz.com).

The Governance Group has already commissioned the development of a recommended Flood Risk Management *Protocol* and expects to receive this in mid 2005.

This work has been entrusted in the Central Government's Proposed Programme of Work to review Flood Risk Management in New Zealand.

The membership of the Governance Group is:

Member	Representing	
Graeme Martin	Chief Executive Otago Regional Council	} <i>Representing Regional Councils</i>
Jeff Jones	Chief Executive Environment Bay of Plenty	
Andrew Caseley	General Manager The Hawkes Bay Regional Council	
Sue Powell	General Manager, Working with Local Government Ministry for the Environment	
Andrew Cleland	Chief Executive Institution of Professional Engineers New Zealand	
Pat Helm	Department of Prime Minister and Cabinet	
George Hooper	Executive Director, Centre for Advanced Engineering	
John Hutchings and Susan Edwards	Local Government New Zealand	

Executive Summary

This purpose of this report is to state the case for, and likely contents of, an improved approach to flood risk management in New Zealand. It does so by reassessing past flood mitigation practices, by promoting current best practice from New Zealand and abroad, and by identifying issues likely to impact on this approach and of the implications of implementing it.

New Zealand's exposure to flood risk continues. Floods occur at all scales and their impacts while first of local importance, can escalate to impact on the national economy. The spectre of climate change adds new concerns. The increasing demand for access to flood prone lands for development and the increasing demands of New Zealanders for better protection challenges both Central and Local Government to ensure the best possible approach to managing flood risk. As the recent tsunami disaster in the Indian Ocean graphically illustrated, it is grossly insufficient to underestimate risk and to under prepare for response and recovery.

The report sets out a recommended structure of an enhanced flood risk management framework, or *Protocol*. It is to be built around a corporate commitment to risk management and will focus organisations into taking a more holistic approach to flood risk management. Understanding natural systems, increased community awareness, maintaining local decision making, improving linkages between Central and Local Government and business, are all aspects of the *Protocol*, which is to be prepared over the next six months.

Flooding, a natural process shaping catchments and their ecology, presents risks to life, property, infrastructure and wealth generation. Flood risk can not be eliminated, only reduced. Central and Local governments continue their efforts to reduce the impact arising from flooding. With New Zealand's active geology and weather systems, the historic use of flood prone lands, coupled with increasing community demands for access to flood prone lands (and this matched by their increasing

expectations for protection), the challenge for improvement is timely.

The solution is simple in design, and one that already has some considerable traction and experience in New Zealand, and is one that is being promoted internationally. A nationally recognised risk management framework is required, based on principles such as: managing risks, not floods; understanding catchments, rivers and streams as systems that respond to interventions; making locally sensible decisions within a catchment context; engaging communities fully in risk assessment. Other principles include making roles and responsibilities explicit, and establishing proper processes from individuals through their communities and councils to central government and its multiple functions, as well as the business sector. Also, as flood risk decisions are being made it will be important to appreciate how these relate to our new quest for sustainability. These are generic challenges of course, echoing a number of changes already occurring. Flood risk is best addressed by being an integral aspect of these changes.

The *Protocol's* objective is to improve New Zealand's performance in managing flood risk by reducing the probability of flood damage through the management of land, river systems, and flood mitigation schemes, and reducing the impact through effective land use planning, regulation, and flood warning and emergency management procedures. Little new knowledge and methodology needs to be developed. The task is for working collectively around existing knowledge and in ensuring broad implementation of an effective risk management framework.

There are political and management challenges in developing and implementing a more comprehensive approach to flood risk management. Implications are significant and require for example: Central and Local government working together under common agreement set out in the *Protocol*; all organisations embracing a corporate risk

management culture; central government departments coordinating their activities; and local government ensuring that its policies, plans and organisational processes embrace social, environmental and economic integration within which to frame flood risk management decisions. In particular regional and territorial councils have to work closely together as both

are responsible for part of the solution.

What is needed is a common understanding and commitment built on an accepted framework through which flood risk can be best managed for communities and their nation. Such a framework is to be developed jointly by the Central and Local Government.

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1 Introduction

1.1 Flooding Impacts

The determining factors of floods are well known. Rainfall and snowmelt provide the input that is concentrated by catchment characteristics into river and stream flows, which are modified as the flood moves downstream. These flows in turn modify physical character by erosion and deposition of debris and sediments, and the ecology by the modifying habitat through for example the transfer of nutrients and pollutants.

It is this feedback that gives catchments their dynamic character, within which New Zealanders seek to establish their communities, lifestyles and economies. While they are an integral aspect of the natural system, floods pose hazards where communities are affected by inundation, erosion, and deposition.

Flood impacts have many dimensions, such as:

- *Social*, including during and after the event: personal stress; demands on social and medical services.
- *Economic*, including: repairing/replacing infrastructure loss or damage; loss of income; loss of income production (such as loss of production lands); loss of property; cost of cleanup, repair and replacement.
- *Environmental*, including: cost of pollutants clean up (sewage, chemicals, debris); new nutrients and soil can be a positive impact; loss of amenity values; loss of habitats; modification of environments.

While a range of mitigation/control techniques exist, the most common one is based upon protecting people and property by building “flood control” infrastructure. This approach, common world wide, seeks to reduce flood risk through engineering solutions by confining, restricting, slowing or expediting flood flows. This remains the major flood management approach, and is very much the public view on how this risk is to be managed.

1.2 Building the Case for New Zealand

The intent of this report is to establish the case for, and likely contents of, an improved approach to flood risk management, by identifying the need for reassessing current practice, by identifying issues likely to impact on the application of this approach, and of the implications of implementation.

Understanding natural systems and the impact of human interventions upon these (and *vice versa*) underpins all approaches to sustainability and risk management herein.

2 The Case for Change

2.1 Drivers for Change

Flooding has significant impact on the social and economic well being of the affected regions and the nation. Floods at all scales continue to be important regional events around New Zealand.

While there are no statistics which provide a cumulative, collective assessment of flood impacts over time, on either a regional or national scale, the significance of flooding can be seen in data from the Insurance Council of New Zealand. Floods are recognised as the cause of 65% of the weather related claims. The recent large floods in the North Island had a significant local and national impact, counting in the hundreds of millions of dollars in costs, with immeasurable social and environmental consequences.

New Zealand's active geology and weather systems, with the added spectre of climate change, will result in floods continuing to impact on New Zealand's people, communities and economies. The historic use of flood prone lands, coupled with increasing community demands for access to and production from these lands (and this matched by their increasing expectations for protection), there is a need to reassess flood risk management in a strategic, comprehensive manner.

2.2 Planned Response

In response:

- Central government is re-assessing its role and seeks a way to reduce the human and economic effects of disasters or better manage its involvements in recovery contributions.

And

- Regional Councils are reassessing their approach to flood mitigation.

Two inter-related flood mitigation studies are being undertaken. One is a suite of work being led by the Ministry of the Environment as a "whole of government" review of how best to manage flood risk and mitigation. The second

is the initiative by Regional Councils to develop better processes for assessing flood risks and selecting mitigation options. This initiative will produce an improved framework, or *Protocol*, for flood risk management.

When complete the Regional Council *Protocol* will reflect the commitment of Central and Local Government and Professional Associations to an integrated approach to managing flood risk. Such a review should consider best practice in river engineering, suitability of tools (technical, legislative), integration of resource management, emergency management, and engineering objectives, etc. Comparisons with current and planned overseas practice are important.

The Government study will also consider reviews of recent large floods and linkages with related Government reviews (e.g. Earthquake Commission, Climate Change, pest control, East Coast Forestry Project and Government emergency response assistance following disasters). The Government study is intended to particularly pick up on legislative, Crown policy, legal obligations and responsibilities. This study is to be very challenging of existing arrangements and approaches and look to an improved integration of social, economic, legal, funding and technical arguments, obligations and expectations.

The two studies are closely linked by Cabinet and Departmental support for the Regional Council initiative both in terms of funding assistance and incorporation as a central component of the Government study.

The context for these studies is being influenced by significant concurrent pressures, for example:

- The Civil Defence and Emergency Management Act 2002 sets out new expectations for hazard management under the "4R'S" (reduction, readiness, response and recovery).
- The Local Government Act 2002 sets out expectations and process (Community

Outcomes) for Community and Local and Central government cooperation around the social, economic and environmental framework of sustainable development.

- Central government is in the process of considering its approach to civil defence and emergency management.

And as nature awaits no one:

- Shifts in precipitation regimes and sea level rise may already be upon us.

2.3 Situational Factors

River management functions of Regional Councils originated in Catchment Boards and Central Government controls, and these functions have since 1989 been managed within an organisational setting focussing on resource management. The Regional Council *Protocol* work presents a good opportunity to assess how well integrated river management and flood protection is with wider community and Council aspirations, Central Government expectations, and modern societal expectation of risk management.

Redistribution of responsibilities occurred in the 1990's when research became the responsibility of Crown Research Institutes. In this new organisational context the research responsibility for natural hazards became a responsibility of the Institute of Geological and Nuclear Sciences, hydrological databases and flood modelling the role of the National Institute of Water and Atmospheric Research, and local government was to manage flood risk. Because of this distribution of responsibilities, a focussed, shared science (pure and applied) agenda pertaining to flood risk management has not emerged.

Since it withdrew from funding catchment schemes in 1988 Central Government has been very cautious about providing funds for flood damage recovery. However it maintained its concerns over the effects of floods on the national economy and the welfare of New Zealanders, and of the competency of local government in managing their responsibilities. Since these changes came into effect flood risk has not been a focus of central government policy development. Indeed some of its capacity has been lost as it focussed on other

priorities. It has however been impacted in the aftermath of significant floods with unbudgeted expenditure particularly on the social aspects of flood disaster recovery

As with all hazards this presents a challenging responsibility matrix between levels of government that cannot be expected to readily lead to the best management of risk.

2.4 Organisational Implications

Reducing risk calls for collective action across this matrix of responsibilities. Within the current context, addressing this responsibility will require Regional Councils to assess these key relationships:

- Amongst themselves to determine the level of commonality in approach to ensure the best community risk outcomes within their regional context (priorities, finances, politics, etc.).
- Within themselves for ensuring an integrated approach to managing hazards.
- With territorial authorities for ensuring common outcomes, transfer of knowledge, data management, land use changes, etc.
- With communities and individuals for ensuring that risk is addressed in a meaningful way (financially, socially, economically).
- With central government for ensuring partnerships are established and roles and responsibilities are clear and respected.

For District and City Councils the key implication will be to ensure that land use policy and plans are consistent with the flood risk management strategies of the Regional Councils.

These relationships have technical, management and political dimensions.

Within the current context, addressing this responsibility will require Central Government to assess these key relationships:

- Amongst government departments whose jurisdiction impacts on flood risk management decisions to ensure that there is coordination between departments at all stages of the CDEM Act's 4 R's of Reduction, Readiness, Response and Recovery.

- With local government for ensuring partnerships are established and roles and responsibilities are clear and respected.

Relationships between governments and business, particularly the insurance industry, are a shared responsibility.

2.5 There is No “Do Nothing” Option

Today many communities are becoming aware that their flood risks are becoming more complex. However, many people and organisations affected by those risks are not prepared to accept mitigation measures that may impose funding costs, reduce property values, limit access and use of lands, or reduce property potential / amenity. This leads to communities choosing a “do nothing” option for flood risk mitigation. This means no physical protection, and usually *ipso facto* no added land-use or building controls for existing or future property developments.

Such reactions are often justified by the reasonable interpretation that the flood will not happen in “my time”. The probability of a damaging event during current property tenures is often less than 50%. Mean tenure times are short, usually in the range 3 to 15 years, and the concern is about flood events of annual probability of 1:50 years to well beyond 1:100 years. But the one certainty is this: if there is a non-zero probability of a damaging flood event, it will happen.

Mostly, however, if the “do nothing” option is chosen, the consequences of the choice are not dealt with and the necessary responses are not taken. In short the identified risk is ignored. This is an unacceptable community outcome. If a community has identified concerns about a flood risk, irrespective of whether or not mitigation by physical protection works is possible or acceptable, response actions must be taken. As there are consequences arising from any decision, the reality is that there is no such option as a fully “do nothing” one.

If a community’s “do nothing” choice on physical protection works is to be sustained by their local Council, the consequences of that choice must be responded to. These consequences and responses are the

mitigations (for society) that stem from the choice.

Such response consequences may involve action to:

- Establish flood warning and flood forecasting systems that will help people to better manage life and property through a flood event (thereby reducing the cost and loss from the event).
- Impose planning and building controls (requiring floodable building design and/or protective positioning for all new buildings or alterations to existing buildings).
- Create bylaws for planned evacuation, temporary location, and return to affected areas (action being outside CDEM response plans and any declaration of a CDEM emergency),.
- Set event triggered controls (thereby preventing or controlling re-establishment of buildings and services after a prescribed level of flood event, thus allowing the status quo meantime but not allowing it to be perpetuated to further flood events).
- Ensure insurance companies and mortgage lenders meet their responsibilities.

All flood mitigation choices have their consequences that must be dealt with. For structural flood defences they will involve assured maintenance, response plans for foreseeable issues (e.g. debris accumulation, power failures), and the passage of super-design events.

2.6 What Others Are Doing

New Zealand is not alone in seeking to improve its management of flood risk. Other countries, including England, Ireland, Holland, Switzerland, and Australia are assessing alternatives, setting legislation and policy, and developing implementations. While these initiatives vary in intent and extent, they include some or all of the following:

- Taking a catchment-wide perspective of flood risk management.
- Allowing rivers to return to their unrestricted dimensions and pathways (living with rivers).
- Assessing all risk management measures,

within changing social, economic and environmental contexts.

- Adopting a range of flood risk management measures including non-structural ones.
- Adopting adaptive management techniques to ensure the flood risk management decisions provide sustainable solutions for the long term.
- Assessing the performance of flood and coastal defences.

- Increasing the engagement of communities in flood risk management decisions.
- Developing resilience strategies that analyse the whole discharge regime, that focus on recovery to increase the rate of return to “normalcy”.

There are many important New Zealand examples where similar initiatives have been implemented. The *Protocol* will take full advantage of these examples and their experiences.

3 Evolution of Flood Management in New Zealand

3.1 Historical Perspective

Early migrants to New Zealand, as elsewhere in the world, choose to establish communities around waterways which allowed access by boat for transportation and security, which afforded a water supply and which was often used to carry away waste. While their initial risk analysis must have discounted the impact of flooding against all these other benefits, European settlers did see the need to form river management boards at the then provincial level. Flooding impacts were initially small but as communities grew and flood related problems of erosion and inundation increased, nationally based solutions became important.

This period was noted for the competitive and often confrontational approaches as various local body interest groups strove to protect their communities.

The evolution of the administrative and legislative responses is discussed below; however the critical aspect to note is the continued focus on structural solutions. The intention was to control flows in spite of natural processes and in spite of adverse consequences of such control inventions. Structural solutions remain a significant dimension of current flood risk management in New Zealand. River management philosophy here in New Zealand followed the world wide view that nature could be controlled.

3.2 The National Water and Soil Conservation Authority (NWASCA) Era (Pre November 1989)

The framework for rivers and flood management was substantially reviewed and coherently established with the enactment of the Soil Conservation and Rivers Control Act 1941 (SC&RCA). This Act (and amendments) set the following key philosophies:

- 1 Mechanisms for river control and reduction of flood losses were provided at both community and individual scales.
- 2 Institutional structures were provided to allow the purposes of the act to be promoted. These institutional structures

involved responsibility for considering flood hazards and enabled actions to be taken for community benefit. A limited degree of coercion on property owners and ratepayers was provided.

- 3 Institutional structures recognised and provided for a very strong national interest oversight, direction and funding. This was achieved through the Soil Conservation and Rivers Control Council (SC&RCC).
- 4 Local rating powers for benefits derived from physical flood and land erosion mitigation measures.
- 5 A whole catchment approach from source to sea.

The SC&RC Act was allied with the Water and Soil Conservation Act 1967 (W&SCA), which established a revised regulatory regime for water and with the Town and Country Planning Act 1977 (T&CPA), which established revised regimes for regional, district and maritime planning. These three acts, all administered by the Ministry of Works and Development (MWD) exerted institutional and management control on floods, erosion, water use and land use.

The SC&RCC, and more latterly the National Water and Soil Conservation Authority (NWASCA, after legislative amendments morphed one into the other), was a potent force for influencing flood mitigation works. This strength of control and influence was by virtue of generous funding incentives for investigations, design, property purchase, construction, maintenance and flood repair. These funding incentives were generally \$3 for \$1 or better, thus rarely did flood protection works proceed without Crown funding and thus Crown approval. This meant the SC&RCC and NWASCA could, *de facto*, specify flood protection standards and mitigation measures. The Crown agencies concentrated their focus on physical protection works although, as evidenced by the NWASCA commissioning of the “Erickson” report, there was a dawning awareness that structural containment works were not the universal answer to flood risk problems.

Through the NWASCA years of 1941 to 1988,

promotion of flood protection works was done with increasing focus on economic benefit, ultimately tested by an internal rate of return requirement for funding support. Super-design event management and changing flood risk patterns (even those arising directly because of approved works) were not a conscious part of thinking. Structural containment solutions were greatly advantaged against other forms of mitigation and the very dynamic nature of flood risks was largely ignored. In regulatory terms such issues were generally beyond legal challenge. Legal challenge was in essence confined to rating fairness, degree of benefit, property requirements, and recompense for detriment surrounding construction of physical flood defences.

3.3 The Regional Council Era (post November 1989)

Local government reform established regional government whose functions were water and soil conservation, regional planning, etc. Significant changes to the country's institutional, social and legal framework followed. Many changes started abruptly in 1989 but some, such as the Resource Management Act, were foreshadowed and were given final effect with legislation in the early 1990's. Immediate changes included:

- 1 National institutional frameworks and interest were removed – NWASCA and MWD had just been abolished in 1988; national funding for flood protection investigations, design, construction, and maintenance was terminated; and wider grant funding for administration and resource investigations for the SC&RCA and W&SCA ceased on termination of existing commitments.
- 2 Flood damage and emergency support funding was largely withdrawn.
- 3 New works could only proceed if community consultative processes and appeals could be successfully navigated under the 1989 Local Government Act amendments and funding circumstances.

From 1988 to 1992, in accord with changing societal views, New Zealand locked into place a legislative stance giving strong weight to individuals and their rights, thereby lessening the ability to implement programmes of strategic community and societal importance.

This shift was accompanied by a growing litigiousness and political activism against rate funding unless strongly driven by user pays concepts. These changes included:

- 1 The Resource Management Act 1991 introducing wide environmental controls on environmental effects, including effects on property. In so doing it created very wide appeal potential, even on projects for community protection.
- 2 The Local Government Act Amendments of 1989 to 1992 introduced stronger public consultation processes and appeal rights for individuals.
- 3 Legislative changes removed a 75% majority criterion allowing imposition of works and rating contributions on flood protection scheme beneficiaries.

These changes were driven further by:

- 4 Local Government Act Amendments that introduced cash funding of depreciation on most council infrastructure.
- 5 The new Local Government Act 2002 strengthening consultative procedures, financial forecasting, and appeal potential for all significant Local Government projects.
- 6 Intensified use of appeals and litigation in defence of private property and personal rights, including rights for interested but not physically affected persons.

The key point from this history is that the national interest, funding, legislative, government, local authority, private institutional, business and social environment has undergone dramatic and exceptionally rapid change from 1988. This makes Regional Councils markedly less able than their predecessor NWASCA-guided Catchment Authorities to advance community flood mitigation projects, yet the need for improved flood mitigation grows as flood risks change and increase.

Compounding these issues for Regional Councils is the fact that during the 40 plus years of the pre-1989 NWASCA era, relatively few flood mitigations were put in place given the vast national flood risk exposure. Mostly the mitigations done were rural schemes based around growth of primary production, as it was this growth which provided the "economic" key

to unlock the Government funding through a strictly Treasury controlled benefit cost analysis which made little attempt to recognise or quantify any social, environmental or cultural costs. Several significant urban schemes were completed as well.

The harder problems; problems not amenable to low cost, low technology, structural containment, problems of low probability high damage events, problems not resolvable with massive Crown financial incentive, and problems for which works done were but an expediency and palliative, were simply not part of the action. These tough problems were ignored and left to continue their insidious growth. These past problems now rest with Regional Councils to give response, to expose, and to solve. In the changed political, legal, business, social, and institutional circumstances this is a tough, almost impossible, task.

Since 1989, with the advent of Regional Councils and the cessation of NWASCA grant funding for scheme repairs and maintenance, new statutory requirements for asset management planning, and funding of depreciation and loss of service potential, the serviceability of flood protection schemes has greatly strengthened. However there are a few instances where affected communities have had to accept a run down or abandonment of unaffordable flood and erosion control schemes, and this trend may regrettably continue.

3.4 Professional Touchstones

Pre-1989 flood mitigation was very strongly influenced and directed by the Crown. The Ministry of Works and Development (MWD) was one of three control departments of the government [the Treasury and the State Services Commission being the other two control departments]. The MWD held responsibility for the Town and Country Planning Act, The Soil Conservation and River Control Act, the Water and Soil Conservation Act, the Building Act and the Public Works Act. The MWD was a unified public infrastructure investment and standards organisation with enormous effect on private land-use activities. The MWD was the service organisation of the

SC&RCC and NWASCA, and the Minister of Works and Development had responsibility for appointing their membership.

These intertwined responsibilities of the MWD and NWASCA, together with the legislative and societal environment of the pre 1989 era, created a strong position of influence to be able to impose *de facto* standards for flood mitigation. Of most practical significance was that urban buildings and facilities should be protected from flooding at a return period of not less than the 100year flood event (1:100 or 1% annual exceedence probability). Initially rural areas had two *de facto* standards; the 50 year event and the 20 year event, the latter tending to be used only where buildings were not at risk. These *de facto* standards were in empathy with the Building Act protection standard of the 50 year event for single dwellings and public buildings. In later years, the 100 year standard was applied to schemes which provided flood protection for significant areas of low lying land on river floodplains as opposed to river valleys.

The strength of the institutions fiscal influence ensured that these *de facto* standards were accepted and applied with little question and no litigation. These *de facto* standards were professional touchstones, a holy grail, learnt by all, applied by all, and defended by all. But the changes in the nature of the regulatory environment post-1989 coupled with changing attitudes of society have altered that. Communities and individuals now have a greater expectation of being involved, being heard, and taking legal action if they believe a decision is not in their best interest. The result is now a combative environment where professional is pitted against professional, property developer/owner against Council, individual rights against public responsibility, environmental change against public protection.

Our society cannot return to a simple touchstone standard. Flood mitigation is far too complex an issue for that. What we now need is a professionally acclaimed process for sifting the issues; assessing needs, options and consequences; choosing what to do; and definitively taking responsibility for the consequences of that choice.

Yesteryears design touchstones now clearly need to be replaced with a professionally and institutionally endorsed *Protocol* for “community options, community choices, and community responses”. And to make it all work well the community responses are likely to require some power of compulsion.

3.5 Risk Factors

Flood risk in New Zealand is characterised by the following identified factors:

- Existing stopbanking with a design or operating limit that has in many (or most) cases no explicit public provision for larger (greater than 1% to 5% AEP or 1:100 to 1:20 year return period) river flows to be safely discharged.
- Existing stopbanking that may perform insufficiently well because of riverbed aggradation, degradation, overloading of natural foundation materials or tree growth.
- The flood performance of river systems being impaired by bridge crossings, culverts, banks or other structures built by utilities or private individuals.
- Existing stopbanking that through land use and community changes might not afford appropriate protection levels aligned for today’s land uses and community expectations.
- Higher value land uses (intensive farming, dairying, horticulture, cropping, and lifestyle, residential, industrial) on flood plain areas that, for today’s community expectations, have inadequate or no formal flood protection or flood mitigation measures.
- Changing patterns of land use within catchments influencing the hydrologic regime and water budgets.
- Changing weather patterns with attendant changes in precipitation regimes.

Most flood protection works in New Zealand were constructed by Catchment Authorities to design philosophies and standards approved by the Ministry of Works & Development under policy requirements and funding assistance provided by Government via the National Water & Soil Conservation Authority.

Few such works were designed for flood protection beyond 1:100 year return period

events, or had explicit super design provisions, or incorporated rigorous foundation testing into their design and construction. Many schemes were designed for rural farmland protection at 1:50 year return period areas and foundations have been inferred as being adequate due to absence of known past damage, or by specific repair of past damage and failures. The hydrologic data used for defining the service standards were of such short duration that considerable uncertainty is attached to these standards. Some of that rural farm land is now much more closely settled with the popularity of rural residential living particularly in peri-urban areas.

These risks are of course compounding the physical and ecological risks associated with the impact of human interventions on natural systems.

3.6 Summary

Many disadvantages arose and in many cases are still arising from the “traditional”, largely structural, approach to flood mitigation:

- Selecting only one design discharge leads to the same nominal level of protection of different areas, such as cities and agricultural areas.
- There is no formal process of assessment of risk and probably an inadequate consideration of a greater than design event/flood.
- In focussing only on preventing floods the value of alternative and/or complementary risk management strategies are reduced, such as non-structural solutions (e.g. washlands and wetlands), and civil defence and emergency management solutions are reduced.
- Focussing on flood prevention by structural containment means encourages a false sense of safety (as all risks and risk management options are not considered) allowing at times for rapid economic development into at risk areas that would be secondary flow channels, thereby increasing risk and liability.
- Currently flood mitigation strategies can lead to endless raising and improving of the flood management structures, involving the restriction of the natural river dynamics, leading in turn to continuous maintenance

as banks are attacked, and sediment eroded and deposited. A vicious circle of river constraint and response can develop which could ultimately be disastrous.

- Focussing on individual flood management initiatives generally excludes the assessment of the impact of this intervention on the catchment processes, and on the cumulative effect of the interventions themselves.
- Flood protection regimes in the form of structural management may not promote sustainable management of the

environment.

- An expectation that protection will follow development. There is a need to turn this around and have considerably more mitigation of risk through planning and regulation.
- Destruction of river habitat, and amenity and cultural values.

It is heartening to acknowledge that there are many cases where the approach for a more holistic approach argued herein are being implemented.

4 The *Protocol* for Flood Risk Management

4.1 Designing the *Protocol*

Managing flood risk for the future requires attention to the following:

- The inter-relationship of all components of the *Protocol* and that all aspects must form the basis for any flood risk assessment.
- The need to give communities confidence that flood risks are being managed while allowing these communities to choose the best risk management outcome to suit their particular circumstances.
- The importance of clear, understood linkages of responsibility from individuals through their communities and their councils to central government.
- The need to recognise that risk changes over time due to changes in the hazard, the value of exposed assets, and their vulnerability.
- The critical importance of adopting a formal risk management framework within which to address flood risk, and through which responsibilities can be linked from the individual to central government.
- The need to consider the widest practicable range of options (structural and non-structural) to manage flood risk, including residual risk.
- The present and foreseeable socio-economic impacts of flood risks and risk mitigations.
- The need to make flood management decisions within the emerging sustainability frameworks developing under new legislation and inter-governmental planning.
- The importance of the natural water/land systems and their behaviours, within which floods need to be understood and their risks managed.
- The need for long-term flood risk management strategies.

Overall these components must lead the paradigm shift away from defensive actions against flood hazard to management of the risk and living with rivers and floods.

The *Protocol* will provide a framework to

enable practitioners and communities to consider a wide range of options, to understand their likely implications and to provide examples and support (in terms of standards, etc.). The primary intent of the *Protocol* is to encourage wide assessment and optimum and inclusive decision-making. This is how flood risk management decisions are to be made.

The audience for the *Protocol* is local authorities, professional groups (engineers, planners policy makers and scientists) as advised by their practitioners (engineers, planners, policy makers, and scientists) engaged in the design and management of flood mitigation measures, and communities. It will also serve as a framework for how central and local governments will work together.

4.2 Establishing the Right Context for the *Protocol*

The true value of a risk based approach is the broad perspective it engenders. In the context of flooding this approach means examining a wide range of risks and solution options and combinations that should more readily lead to a comprehensive and adaptable approach to flood risk management in each community.

From an organisational perspective it makes little sense to implement a risk based approach for a single hazard, rather all hazards are best examined from this perspective. Hence a corporate commitment to risk management is required. All agencies from central through local government should develop such a capacity, and develop it in common.

Flood risks also are best managed as an integral component of, firstly, an all hazards approach; and secondly, of the corporate commitment to sustainability. Real integration of programmes for social, economic and environmental outcomes is critical for establishing the best context within which to situate the most effective flood risk management decisions. There are significant organisational challenges here for both local councils and government departments.

This integration is presently being promoted, for example, through Community Outcomes incorporated into Long Term Council Community Plans and the government's Programme for Action for Sustainable Development. While real outcomes will take some considerable time to emerge through these processes, it is important to begin now to integrate flood risk management into their development.

Another requirement for flood risk management (and indeed all risk management) is an effective national risk management framework wherein roles and responsibilities are clear, programmes are fully integrated, and relationships amongst the organisations are well managed, providing individuals and their communities with a strategic, seamless service. Improving our response to any hazard will have little lasting impact unless this framework is properly designed and fully implemented.

A particularly critical aspect of this framework is improved relations between Crown Research Institutes, central government science funding agencies, and end users such as local government. The current fractured dialogue amongst these brings little progress in the reduction of risk to communities, flood risk being but one risk. Implementation of a rigorous national risk management framework will have to include the solution to this particularly thorny issue.

4.3 Elements of the *Protocol*

The *Protocol* should be based on risk management concepts (see the Appendix for a basic outline) and consider the following elements:

- The *interaction of natural and social systems*, and the effects of human interventions on both. Under the emerging umbrella of *sustainability* this is an immense – but achievable - challenge.
- The underlying importance of understanding *natural river and catchment processes as non-negotiable constraints on river modifications*, and in linking these as background to flood risk management decisions.
- Changes in natural processes, hazards, exposed values and their vulnerability are

anticipated. A strategic approach based on *adaptive management* principles is required.

- *Context-based decision-making* to find the most suitable way of managing the risks and to ensure that the solution chosen is appropriate for the risks as identified.
- *Continuing community engagement* to ensure as far as possible their understanding of the risk and the choices, plus the development of commitment to personal risk management.
- The *appropriate forms and levels of protection* for the existing and possible future assets under threat.
- Recognition and treatment of *residual risks* such that all risks are addressed. Ignoring any risk is no longer an option.

These need to be developed into a *Protocol* that is framed by a clear understanding of roles and a responsibility between governments such that best practise is accomplished operationally and strategically, and that allows each government to act comfortably within its own mandate, but binds them together to reduce risks to individuals and their communities.

While there is good evidence that some aspects of this *Protocol* are already implemented there is overwhelming evidence that it is not done consistently and systematically, hence the quest for sustainability is presently compromised.

The task of developing the *Protocol* has already begun and while this in itself is a relatively straightforward task, its implementation will be a major and continuing challenge as it carries significant expectations of individual and collective commitment, the present lack of which is placing New Zealanders at risk.

4.4 Addressing the Needs of the *Protocol*

For Regional, District and City Councils the implications of endorsing similar approaches to managing flood risk can be significant:

- 1 To situate flood management within broader contexts of catchment, and socio-economic sustainability planning and

management; and

- 2 To take a holistic look at flood risk and assessing the widest practicable range of options for managing this risk within the contexts of (1) above.

This approach to flood risk management will require:

- The development of catchment management approaches, landuse plans and socio-economic understandings (within the sustainability context). Research agendas and methodology development will be required and appropriate outcomes defined.
- Sound inter-council relationships to ensure commonality of purpose and coordination of policy.
- Coordination if not integration of regional and district/city council functions such as risk monitoring, community planning and infrastructure engineering. Flood risk management outcomes for catchments and their communities require definition so that information requirements, community awareness and necessary responses can be identified and addressed.

For central government the implications are recognised as:

- A “whole of government” framework for policy development and programme delivery to address flood risk management (again in the broader contexts of socio-economic and environmental sustainability and comprehensive risk assessment).
- A legislative framework that enables comprehensive risk management and also ensures respective roles and responsibilities are clearly established between itself and local government.
- An approach that places an appropriate level of importance on wider community benefits while catering, within reason, for individual issues.

Central and Local government share these implications:

- An inter- and intra-council and government adoption of risk management. Corporate cultures have to be set appropriately, information systems established, and roles and responsibilities clearly defined and supported.

- Political awareness and commitment to making long term decisions on flood risk management for at-risk communities.

Enhanced knowledge is required, for example:

- Better understanding of river and catchment behaviour.
- Non-structural options for flood risk management.
- Infrastructural options and assurance programmes
- Risk management
- Risk Communications
- Catchment management
- Integrated policy development and planning for socio-economic and environmental sustainability outcomes.

With their varying financial abilities, political directions and priorities, each Council can be expected to address these implications in its own way. The amount of work required of course depends upon the Councils’ current state of policy and programme development to support sustainable outcomes. However for the final *Protocol* to have meaning it must be accepted in principle by all, and for Government, all Councils, and key professional and industry groups to commit to its implementation.

While straightforward in development the tasks required to develop the *Protocol* are significant, for example:

- A methodology for assessing the level of service of existing or possible future schemes needs to be developed.
- A methodology for corporate risk management is required as is a methodology for assessing flood risk.
- Understanding catchment management concepts as these might contribute to better, more comprehensive risk management assessments, and then operationalising these will be challenging.
- Understanding how to link flood risk management decisions with the ongoing programmes on environmental quality and social/economic development.
- Understanding the current condition and level of protection provided by existing

flood mitigation schemes is a critical aspect of moving forward on implementing the *Protocol*. In light of the acknowledged risk factors, the relatively narrowly defined levels of protection, and the changing hazard conditions, it is essential that communities are aware of the performance of these schemes. Where these schemes are to be modified it is essential of course that this is done through application of the *Protocol*.

In order for this *Protocol* to be successfully implemented many significant challenges will need to be addressed:

- Local government will need to, for example:
 - Collectively implement the *Protocol*, while maintaining their sovereignty and individuality.
 - Ensure that Territorial and Regional Councils relations are appropriate for developing and maintaining proper flood risk management.
 - Ensure expertise and training for staff, politicians and communities is available.
- Central government will need to deliver on, for example:
 - An effective “whole-of-government” approach to risk management and for flood risk management as part of this approach.
 - Any necessary legislative changes.
 - Clear policy to guide central government intervention in flood risk management.
- Both levels of government will be expected to ensure that New Zealand’s flood risks are managed competently, funded appropriately and are dealt with seamlessly, leaving no gaps and uncertainties for themselves, their communities and individuals.
- Professional bodies will have a major role to play in, for example:
 - Development of technical support for the *Protocol* approach (codes of good practice, analytical tools, training, etc.)
 - Collective participation in cross-disciplinary awareness and training initiatives required to support the implementation of the *Protocol*.

Appendix: Developing a Risk-based Approach

Risk Management

A risk management perspective provides a useful framework for all hazard assessment.

The purpose of risk management is to:

- 1 Reduce the occurrence of harmful or unwanted events
- 2 Improve assurance (individuals, companies, politicians) in times of rapid change and uncertainty
- 3 Enable people to do those things they wish to do, in the confidence that the risks are properly managed and controlled.

The first step in risk management is to identify and characterise threats and potential threats. Protective or mitigative arrangements to these threats require understanding:

- 1 Of what risk or part of the risk is being addressed.
- 2 On how effective the control will be and what percentage of the risk is removed.
- 3 Of the effectiveness of the implementation of the control measures (what risk reduction is achievable in practice, how to address residual risk, etc.)

It is vital to look at any downsides and possible adverse consequences of risk control.

In delivering the best risk solution it is important to know:

- 1 Who is affected by this risk?
- 2 What their concern, expectations, interests, attitudes, etc. are?
- 3 What can realistically be achieved in balancing all the interests involved?
- 4 How the risk solutions are to be delivered in terms of managing the risk and the effects of change, and in terms of people's confidence that this is being properly managed?

Flood Risk Management

Flood risk is a function of flood hazard, the exposed values and their vulnerability, and increases in flood losses can be attributed to

each of these aspects. In some cases these can combine to aggravate losses (such as increased flood levels in fast developing land).

To manage these risks in a sustainable, effective manner requires a broad approach that should incorporate legislation, strategies, policies, and plans.

Applying risk management to flood management encourages a comprehensive approach where hazards, community values (for their society, economy and environment) and vulnerabilities are considered. This is done in an interactive, holistic manner, thereby facilitating the right discussions for the implementation of the objectives for sustainability.

Overall this exercise should lead to new or improved risk management systems for flood risks that are embedded into the risk-based organisational culture of the organisation and linked with other risk management systems to central government. The required outcome is systems within systems, working together. There is little value in developing the *Protocol* for managing flood risk without ensuring that all these risk management systems are addressed.

Within organisations risk management requires a structured approach emanating from policy. First there is political policy setting in terms of how the risk is to be addressed and secondly there is managerial policy setting to ensure the supporting systems and organisational culture are in place and functioning. The latter should include: clear statements of responsibilities and accountabilities; training, education and performance review; information systems; outcomes and outputs evaluation; and regular management oversight.

Risk Communications

Risk communications are defined as the purposeful exchange of information about risk between interested parties, namely organisational entities and those they serve.

Risk communications is the act of conveying information between interested parties about levels of risk, the significance of such risk, or decisions, actions or policies aimed at managing or controlling such risks. It includes multiple messages about the nature of risk and other messages, not strictly about risk, that express concerns, opinions or reactions to risk messages or to legal and institutional arrangements for risk management.

Risk communications need to be defined to meet the needs of interested parties, which for local government, can mean, individual ratepayer, associations of ratepayers, economic sector groups, other local and central government bodies. The key to successful risk

communications is being interactive, which includes the obvious need to be open-minded.

It is clear that problems associated with flooding are often not sufficiently recognised and understood. To be aware means that people understand the risk and know how to respond. The community should be aware that there might be a need to restrict use of flood prone areas. Individuals should be encouraged to take their own flood risk measures (readiness, reduction, response and recovery) and of course they need to be informed before, during and after a flood event.

The best risk management outcomes for the community depend upon how well it is engaged in the risk management process.