GeoNet Project
Triennial Review (2001-2004)

Integrated Risk Management

Report to the Earthquake Commission

CONTENT

SUMMARY

This Triennial Review is timely not only in the life cycle of the contract between GNS and EQC for the provision of GeoNet but also in terms of developments in the national risk mitigation framework. New legislation is reshaping emergency management and setting new roles and planning processes in both levels of government. GeoNet is essential for New Zealanders' understanding of the risks they face from the land they stand on and therefore, within the right framework, is potentially a valuable contribution to governments in meeting their responsibilities for hazard identification and mitigation.

GeoNet in its original conception is a well-designed project which meets the best international standards and is supported by a group of well-qualified scientific staff. The project is also being well managed within its constraints. It is a good model for financial management, research direction setting and quality control, implementation decisions and network design. The research and technical staff developing GeoNet are a valuable national resource.

GeoNet exists today almost entirely because of the vision and commitment of its two principal partners, GNS and the EQC. The basic data from GeoNet is made available as a public good for all and the panel supports this approach. The GeoNet Project is poised to make a valuable contribution to public good but this opportunity can only be realised if the GeoNet sensing network is built to at least the original specification, stable and continuing funding is provided for its operation and the necessary research and modelling capability to produce useful information from the data thereby acquired.

To achieve these objectives requires an agreement amongst all stakeholders on exactly what GeoNet will provide, how it fits into a national risk management framework and how future capability will be funded. EQC's baseload funding contribution remains vital but further necessary developments in capability will require increased total funding. Further contributions from EQC would clearly be welcome and could be justified by its general mandate for research.

Efforts to develop partnerships or clients for the GeoNet Project have been only very occasionally successful. The relationship with potential stakeholders is quite uneven. Reasons for this include an emphasis in the project on getting the network built and developing the capacity to use it rather than marketing its value to stakeholders; lack of a clear understanding between potential users and GeoNet on exactly what the project will produce of value to them; and reluctance by some to contribute to what they see as a national tax-funded responsibility. In order to address this problem the respective roles of EQC and GNS must be clarified, with the former focussing on stakeholders (within a national risk management framework) and the latter focussing on clients for products and services built upon GeoNet outputs.

The public good element of GeoNet requires a larger continuing commitment from FRST; unfortunately FRST has withdrawn some of its support and plans to remove another substantial slice in two years' time. Funding should also be sought from others who will derive specific benefit from GeoNet products in their roles in the national

hazard management framework, including particularly MCDEM. As a first step, the Panel recommends that the Earthquake Commission jointly convene a meeting of interested stakeholders to discuss the further development of the network and its funding. Ultimately, a decision may be required from Cabinet on how additional funding responsibilities should be allocated.

RECOMMENDATIONS

The GeoNet Project is a contribution to the public good for which the Earthquake Commission should be justifiably proud. In providing basic data and information on natural hazards of national significance the GeoNet Project contributes to the overall need for hazard and emergency management in New Zealand. Outputs from GeoNet should not be considered as isolated contributions; rather they form one backbone for risk management at local and national levels.

In recognising the importance of the GeoNet investment to the New Zealand risk management framework the Panel has set out a sequence of recommendations targeted at creating the right "space" for GeoNet. However in doing so the Panel appreciated that some of these recommendations stretch, if not go beyond, the existing mandate for the Earthquake Commission. In this regard the Panel asks that the Commission considers the recommendations it can address within its mandate, and as well, considers how to bring best effect to the others, for they are all important for maximising the GeoNet Project investment.

The recommendations are:

1. That the weak-motion, strong-motion and geodetic networks be deployed as originally planned in March 2000 to enable reliable detection and location of earthquakes anywhere in New Zealand and to allow rapid production of an instrumental "ShakeMap" within 30 minutes of an event.

2. That the Earthquake Commission gives effect to (1) by increasing its funding support for the GeoNet Project to the level originally proposed in March 2000.

3. That an agreed, appropriate level of non-contestable research funding to support GeoNet be secured through FRST over the length of the contract to ensure the design of GeoNet continues to meets international best-practice guidelines over time.

4. That discussions begin immediately with government on how the costs of the hazard mitigation and research outcomes should be shared.

    4.1. That as part of the solution arising from these discussions a long-term commitment of research funds (to direct the network and to develop its outputs) be established through FRST.

5. That, once the outcome of the preceding initiative is known, an inter-agency stakeholders' committee be established through which the research and other outputs and expectations of GeoNet can be more precisely specified and agreed. Such a process could be managed through the Earthquake Commission, the Ministry for Civil Defence and Emergency Management or via a research consortium

    5.1. That stakeholders include local government, universities, other government departments as identified, emergency services, and public and private utilities.

6. That the Earthquake Commission engages in discussions with other government sectors with a view to participating in an integrated approach to risk management within which to effectively situate their GeoNet investment. These discussions should be in parallel with the completion of the fit-for-purpose GeoNet functionality to the agreed original scope (March 2000).

7. That GeoNet and EQC prepare a fall back position should funding prove insufficient. As the existing investment in GeoNet should not be compromised, expansion of the network would be curtailed to secure a sustainable operating budget and added value analysis of information deferred indefinitely.

8. That the Earthquake Commission's oversight of the GeoNet Project be strengthened to ensure:

   8.1. A proper balance between monitoring and supporting research priorities.

   8.2. Effective relations with stakeholders including reinforcing the value of GeoNet in hazard mitigation and research and support for stakeholders' use of GeoNet data and products. The continuation of the GeoNet brand will be important to promote the public good aspects of the Project.

   8.3. That the GeoNet Project is effectively linked to the broader strategy for risk management in government and private sectors.

   8.4. That the FRST/GeoNet research funding decisions are consistent with a national risk management framework.

   8.5. That research funds are allotted to developing practical management tools for defining "how much data and information is enough" for providing direction to GeoNet, and for understanding how uncertainty around decisions should be treated in terms of the available data and information.

   8.6. That GNS continues to engage national and international expertise to provide ongoing comment on the design and operation of GeoNet.

   The Panel notes that these responsibilities are beyond the existing mandate of the EQC Research Subcommittee now responsible for the GeoNet Project.

9. That New Zealand develops a formal plan for coordination of research efforts after major events. Such a group might include the role of GNS/GeoNet staff, university groups, LINZ and others.

ACKNOWLEDGEMENTS

Throughout its engagement the Panel was well supported by Hugh Cowan, GeoNet Project Manager, Institute of Geological and Nuclear Sciences (GNS). Terry Webb, General Manager Natural Hazards, GNS, made himself available throughout the process as did David Middleton, General Manager of the Earthquake Commission. The EQC Board met briefly with the Panel. All these interactions were professionally managed in ensuring information was available and questions were answered, while leaving the Panel to reach its own conclusions.

The Panel benefited greatly from the efforts of GNS staff to inform of the nature, extent and issues arising from the first three years of GeoNet implementation. The Panel wishes to acknowledge Ken Gledhill, Kevin Fenaughty, Geoff Clitheroe, John Beavan, Martin Reyners and Andrew King in this regard.

The Panel wishes to recognise the significant contribution of those who agreed to be interviewed. These were all senior persons who have considerable demand on their time and without whose input the Review would have floundered. These persons were: Graeme Blick of Land information NZ; Basil Morrison and Eugene Bowen of Local Government NZ; Euan Smith, the Victoria University at Wellington; Jim Cole, the University of Canterbury; Michele Daly, Kestrel Group; Basil Chamberlain, Taranaki Regional Council; Helen Anderson, Ministry of Research Science and Technology; Nick Allison, Foundation for Research Science and Technology; Pat Helm, Department of Prime Minister and Cabinet; and John Norton, Ministry of Civil Defence and Emergency Management.

The Panel also thanks Sue Hatfield of GNS for her accuracy and perseverance in recording its discussions.

INTRODUCTION

Background to Review

The GeoNet Project was launched in July 2001 based on a ten-year plan financed by the Earthquake Commission. The underlying intention was to build and operate a modern geological hazard monitoring system covering New Zealand. The original vision was for a capacity that would facilitate detection, data gathering, and rapid response related to earthquakes, volcanic activity, large landslides and the slow deformation that precedes large earthquake and eruptions.

The Earthquake Commission long recognised the importance of a triennial review and this commitment to good management was made even more important as a consequence of the following issues surrounding the GeoNet Project:

- It was launched without the full financial support first envisioned and the impact of this limitation on the character and competency of the Project needs to be examined.

- It has focussed on building the basic operational network and it is important to reflect on the success and appropriateness of this focus, versus the broader objectives of the GeoNet Project.

- It has recently suffered a critical loss of financial support for research activities, and also had to adjust to a reordering of output priorities. Research is important as it guides the development of the Project and the development of much needed value-added products/outputs.

- As operational, scientific and public policy knowledge continue to evolve, it is always important to take a step back and ensure that the operational, management, communications and knowledge development strategies driving project decision making are current and appropriate.

And importantly:

- The public policy environment surrounding GeoNet activities, and indeed those of the Earthquake Commission itself, is in flux as central and local government, and businesses, seek to reduce economic and social impacts of hazards and disasters. The outcomes expected from the Triennial Review Panel's deliberations are expected to provide more definition for the processes and outputs of the GeoNet Project.

Terms of Reference

The review was to address three key themes:

1. *To undertake a review of the existing built system and current work plans against original objectives and comment upon priority areas for future investment so as to ensure original objectives are fully met.*

   This objective is to meet the expectations of the contract between the main funding agency (Earthquake Commission) and the lead operational agency (Institute of Geological and Nuclear Sciences Ltd).

2. *To assess the overall needs for viable national capacity for geological hazard research and optimal contribution from current and planned investments in the GeoNet Project.*

   This objective is to address a funding problem for GeoNet operations, and volatility in the levels of contestable public research funding, the balance between operational and long-term research and the uncertain institutional accountabilities for stewardship of basic capacity and direction. These issues influence the ability of any New Zealand institution to exploit the growing volumes of high-quality data for national benefit.

3. *To devise a framework for meeting the cost of GeoNet, aligning responsibilities and funding ability with measurable benefits which contribute to risk management at local and national levels.*

   This objective is to re-evaluate the GeoNet program goals against broad socio-economic objectives of Government. The context is legislation that among other things empowers the Earthquake Commission to fund GeoNet and facilitate research, and other legislation that introduces new expectations of civil defence and emergency management at all levels of government and commerce, with increased focus on preparation, mitigation and recovery planning.

(Note: The Panel found that many observations were interlinked, thereby complicating our responses to each objective. Where there is inevitable overlap as a consequence this really serves to emphasise those issues considered most important by the Panel.)

Current EQC Review

On 07 September 2004, as the panel was preparing for this review, the Minister responsible for EQC, Hon Dr Michael Cullen, announced a review of the applicability of the EQC scheme to floods and other natural hazards.

The EQC review seeks to align EQC activities more with the government's overall approach to risk management. Its funding of GeoNet is an important EQC contribution to this objective. The Panel therefore suggests that this report should be provided to those undertaking the overall EQC review.

Panel Strategy

In order to appreciate the working environment and technical details of the GeoNet Project, the Panel began its deliberations with a full day's briefing from the staff and managers at the Institute of Geological and Nuclear Sciences (GNS). The names of those presenting to the Panel are recognised in the Acknowledgements. The Panel greatly appreciated the enthusiasm, professionalism and openness of these staff.

Next, in order to appreciate the context within which GeoNet is being developed, the Panel interviewed a series of senior representatives from central and local government. The Panel appreciated the time and effort of these representatives and as with the GNS staff, the openness and professionalism of their communications. These representatives were:

Land Information New Zealand	**Graeme Blick** Senior Geodetic Advisor Office of the Surveyor General Land Information New Zealand Wellington
Local Government New Zealand	**Basil Morrison** Chair Local Government New Zealand
	Eugene Bowen Chief Executive Officer Local Government New Zealand
Universities	**Dr Euan Smith** Professor of Geophysics School of Earth Sciences Victoria University of Wellington, Wellington
	Dr Jim Cole Director, Natural Hazard Research Centre University of Canterbury Christchurch

Regional Councils	**Basil Chamberlain** Chief Executive Taranaki Regional Council New Plymouth
	Michele Daly Kestrel Group Auckland (ex Auckland Regional Council)
Ministry of Research Science and Technology	**Dr Helen Anderson** Chief Executive Officer Wellington
Foundation for Research Science and Technology	**Nick Allison** Manager of Policy Wellington
Department of Prime Minister and Cabinet	**Pat Helm** Senior Science Adviser Wellington
Ministry of Civil Defence and Emergency Management	**John Norton** Director Wellington

The review panel convened on 5 October 2004 with presentations and interviews carrying on through 7 October 2004. The Panel's final report was to be submitted within three weeks.

Composition of Panel

In recognising the breadth of issues to be considered in the review, EQC selected a panel that brought sufficient skills, experiences and reputations together to ensure that the multi-faceted issues were properly addressed and done so in an integrated manner.

The panel members and their key competencies were:

- ***Panel member***
  William Prescott - President, UNAVCO Inc., BA, MA, Ph.D (Stanford)

  Competencies
  Geophysical monitoring network objectives, implementation and management at an international standard

- ***Panel Member***

Yoshimitsu Okada - Director of Strategic Planning, National Research Institute for Earth Science and Disaster Prevention, Japan, BS, MS, D.Sc (Tokyo)

Competencies
Leadership in national research teams on studies of earthquakes, volcanoes and their impact on society and the public science policy and management implications.

- ***Panel Member***
  Rob Laking – Senior Lecturer, VUW School of Government, BA(Hons), MPA (Harvard)

  Competencies
  Central government approaches to governance, public management, performance and financial management, policy development in social, energy, industry and primary resources.

- ***Panel Member***
  David Miller – Director, Vantage Consulting Group, BA (Waik.), BBS (Mass.), MA (Cant.)

  Competencies
  Business strategy and organisational development in the science sector.

- ***Panel Member***
  Terry Day - Principal, TJ Day Associates, BA, MA, (British Columbia), Ph.D (Cant.)

  Competencies
  Local government legislative and management practices and central government impacts on local government hazard management.

David Miller also acted as Panel Facilitator.

Further details on the credentials of the panel members are contained in the Appendix.

GEONET PROJECT

New Zealand: Managing Risk at a Plate Boundary

New Zealanders live on the edge. Depending on their location, it might be the edge of the Australian Plate, or it might be the edge of the Pacific Plate. The active Pacific-Australian Plate boundary passes through New Zealand producing earthquakes, volcanoes, steep terrain and active deformation. In places the active boundary between the interacting plates is quite narrow, for example the Alpine Fault and Southern Alps in the central South Island. In other regions, such as most of the central and eastern North Island, it is a broad zone of deformation.

Nowhere in New Zealand is immune from the possibilities of damaging earthquakes, and volcanic eruptions could distribute ash anywhere over the North Island. A major event almost anywhere in the country would affect the whole society and economy because of the small size of the country and interdependencies of infrastructure, logistics, and business.

Seismic activity is almost comparable to that of California with the added hazard of deep subduction zone events, which can affect wide areas. Wellington straddles a fault line capable of generating magnitude >7.0 earthquakes. The Wellington fault has a recurrence interval of 500 – 770 years and last ruptured between 350 and 500 years ago. The Alpine Fault that may rupture over a length of 450km has recurrence intervals of 100 – 300 years and last ruptured about 270 years ago. Local earthquakes offshore have the potential to generate devastating tsunami, several of which occurred during the 19th century at a time when the coast was sparsely populated.

All of New Zealand's oil and gas production is in the shadow of Mt Taranaki/Egmont, which erupted less than 300 years ago. The Taupo eruption of 181AD if it occurred today would devastate significant areas of central North Island where there are population centres of over 50,000 people. The caldera volcanoes of this region have produced New Zealand's largest historic eruption and the Okataina and Taupo centres have the dubious distinction as the two most "productive" magma systems on the planet. Auckland is built on 49 volcanic centres, the most recent of which (Rangitoto Island) formed between 600 and 1000 years ago.

The diversity of New Zealand's natural landscapes is among attributes ranked highly by those who live there. The same features attest to high geological hazard, but equally an excellent natural laboratory for the study of geological processes. Although the summary of potential ruin portrayed above is real and characterises numerous events of the first century (post 1830) of European settlement of New Zealand, the previous 60 years have been relatively quiescent. Not since the 1930's and early 1940's – a period in which large shallow earthquakes struck repeatedly - has New Zealand suffered major social disruption or serious economic setback due to geological hazard, although there has been local impact.

Advances in understanding hazard and risk have also occurred on several fronts during that period. The damaging earthquakes of the late 1920-30's prompted the introduction of principles for earthquake resistant design that formed the basis of the first national building code in the mid 1930's. These experiences, together with international influences fostered a vibrant research culture at Government and university departments, and led to new and widely emulated practices in capacity design for reinforced concrete structures.

Reconstruction policy was also an early consideration with the Earthquake and War Damage Commission (later Earthquake Commission) created during the 1940's as an instrument of social policy using the insurance model. It was recognised that economic recovery had been excessively slow in communities damaged by earthquake, due to widespread under-insurance and limited access to capital for reconstruction. More recent (1980-90's) legislative reforms to resource management, civil defence and local government have introduced new expectations of sustainable development and environmental resilience. These reforms, which reflect wider changes in New Zealand public management during the previous two decades, are expected to facilitate risk assessment and reduction at all levels in the community.

Inevitably the decades of relative seismic quiescence pose a challenge for effective management of natural hazard risk today, which must be considered for the GeoNet review. The number of urban dwellers continues to rise and with it a dependency on reticulated services. The nation's infrastructure is being worked harder as a consequence of efficiencies extracted during the previous decades of structural reform. There are few New Zealanders alive today with experience of severe personal loss to geological hazards. Competitive forces in commerce and structural disaggregation of many parts of the public sector are factors that undermine or retard the collaboration and sharing of knowledge needed across organisations and between sectors to effectively manage natural hazard risk. Traditional economic tools are not well suited to assessing optimal allocation of resources to hazard risk management in general and GeoNet in particular.

The GeoNet Decision

Much of the recent progress in seismic and volcanic monitoring in New Zealand prior to GeoNet, as well as geological and earthquake engineering hazard and risk assessment at a national level, can be attributed to EQC. The Earthquake Commission Act 1993 gives EQC two main functions:

1. The administration of insurance against natural disaster damage to residential properties (collecting premiums, administering the Natural Disaster Fund, and obtaining reinsurance) and

2. Facilitating research and education around matters relevant to natural disaster damage (not restricted to residential property), methods of reducing or preventing natural disaster damage and the insurance provided under the act.

Thus, although EQC's role as an insurer is confined to residential properties, it maintains a much broader brief for developing knowledge about natural disasters. It is under the research function that EQC finances the GeoNet Project using income from premiums.

EQC became increasingly concerned about the precarious state of geological hazard monitoring during the 1990's, with no agency actually *responsible* for monitoring and very limited funding available to GNS to maintain its research network, let alone upgrade it to a modern standard or retain high-calibre scientists for earthquake and volcano research.

From the time EQC began awarding ad-hoc grants to GNS for partial upgrades to the national monitoring system, GNS pursued various options for long-term funding of a modern network based on subscription revenue from local government, state owned enterprises (SOEs) and the private sector. A number of alternatives were canvassed.

However by late 1999 it was clear significant public investment and national leadership would be required to deliver meaningful improvements. The EQC invited GNS to prepare a proposal for a national "fit-for-purpose" system, on the premise that EQC, consistent with its legislative mandate, was willing to consider funding this significant public good initiative because:

- New Zealand is exposed to potentially devastating social and economic impacts from geological hazards.
- Existing hazard monitoring and data collection systems were already inadequate and deteriorating further.
- Public good science funding and operational funding for the Ministry of Civil Defence & Emergency Management (MCDEM) were insufficient to fund any meaningful upgrades and this situation was not expected to change in the near to medium future.
- GNS had tried over several years to raise subscriptions to fund monitoring from the wider market of councils, SOEs and utilities with little success

The solution would be, over a ten-year planning period, to develop a project to build and operate a modern geological hazard monitoring system in New Zealand. The hazards within the scope of GeoNet were earthquakes, volcanic activity, large landslides, and the slow deformation that precedes large earthquakes. The design parameters were a network that would not be damaged by the natural events it was supposed to monitor; could return virtually instantaneous and accurate data on any significant event anywhere in New Zealand; and would be managed by staff who could provide rapid interpretations of these data and support for any required emergency response.

GeoNet itself was to comprise the distributed network of geophysical instruments, automated software applications, and skilled staff to support the detection, analysis and communication of results.

The GeoNet Contract

The contract for the GeoNet Project signed between EQC (as purchaser) and the Institute of Geological and Nuclear Sciences Limited (supplier) was signed on 30 June 2001.

Schedule 8 of the contract sets out the key deliverables in terms of management services and data available response times.

Services	Objective
Network Operations and Field Observations	To collect seismic, volcanic, geodetic and landslide data and deliver to the GeoNet Data Management Centres.
Data Management Centres	To provide reliable, publicly available information on new Zealand's earthquakes, volcanoes, landslides and land deformation (the Website Data) to facilitate emergency management, improved recovery, enhanced under-pinning research and long term mitigation of geological risk subject to the Availability Standard.

Original Proposal and Changes in Scope

The network originally planned was somewhat larger than that finally approved in 2001. In the original concept, the total cost to implement the upgrade and operate the system, aggregated over a ten-year period, was determined to be approximately NZ$5 million of annual operating expenses and NZ$32 million of capital, which included estimated renewal costs for the line replacement of equipment. The proposal was closely scrutinised over an 18 month period (including an international technical review, a science policy review, a financial review, and extensive discussions amongst other Crown agencies and potential end user groups, two parliamentary Select Committees and vote Ministers).

In the event, the project was launched in July 2001 with reductions in scope required to reflect a cap on EQC's contribution that was set at $5M/yr and covering both capital and operating costs. This revision in funding was determined by the decision to contain the level of commitment as a percentage of the annual premium income. The constraints and potential limitations anticipated by this funding restriction were clearly identified in the March 2001 Revised Proposal submitted by GNS to EQC. These were identified as sparse instrument coverage, uneven response capability and a slower pace of project implementation.

The major focus of the first three years has been the decommissioning and upgrading of the old national earthquake monitoring system for strong and weak-motion recording, the addition of data communications links, the modernising of data management

practices and the introduction of new initiatives for volcano surveillance, landslide response and earth deformation monitoring.

TERMS OF REFERENCE 1 – EXISTING BUILT SYSTEM

Objective

To undertake a review of the existing built system and current work plans against original objectives and comment upon priority areas for future investment so as to ensure original objectives are fully met.

This objective is to meet the expectations of the contract between the main funding agency (Earthquake Commission) and the lead operational agency (Institute of Geological and Nuclear Sciences).

Comment

The Panel's comments here are mainly about progress with the installation and operation of GeoNet on the current plan. We discuss desirable further enhancements under our second term of reference.

In engineering terms, GeoNet has so far been a well-executed project. The network roll out has been successful with the objectives being met in a timely manner once several initial problems were addressed. The decisions on, and successful commissioning of, the integrated instrumented sites were soundly managed. GNS management appears to have kept EQC adequately informed on progress and variances and EQC management appear satisfied with how GNS has managed the built system for the GeoNet Project.

During this period there were some problems in managing and extracting satisfactory performance from the primary supplier of telecommunication services. However, the original selection of this supplier preceded the establishment of GeoNet, and was evidently clearly the best option at the time. These issues have now been resolved, involving the successful transition to a new supplier. Delays in terms of milestones have been more than made up.

Overall, considering the initial financing limitations, the contingencies that arose during implementation and the uncertainty of research focussed funding contributed by FRST; the Panel is in agreement that the GeoNet Project has been well managed during this period. Management responses to constraints and contingencies have been appropriate, and have been coupled with good financial management (particularly in keeping a clear tracking of GeoNet monies).

Just as importantly, the GeoNet Project has succeeded in adding significantly to New Zealand's scientific capability in geophysical research. We believe that this decision to extend GeoNet's capability beyond simply providing raw data to other users, to developing models to interpret the data and providing support for others to use it, was essential to the success of the Project. We discuss this further in the next section in considering the future development of GeoNet.

GNS and GeoNet management have had more mixed success in securing funding or partnerships beyond EQC. There has been a highly successful partnership with LINZ on the continuous GPS monitoring aspects of the Project and LINZ appear to be well-satisfied with the relationship. The success of the EQC and LINZ relationships reflects both a mutual understanding of what each partner would bring to the relationship. Other overtures to potential partners, such as the Ministry of Civil Defence and Emergency Management, utilities and local government have not been successful for reasons relating to finances, priorities, roles and responsibilities and uncertainty of needs or benefits. Not surprisingly, several stakeholders suggested that central government ought to pay for GeoNet.

The intention of FRST to reduce its funding also came as a major surprise and will significantly compromise the Project's ability to create value-added products unless other funding can be found to replace it. We should add however that FRST has indicated its willingness, with MORST, to reconsider the framework for funding national capabilities – of which the monitoring network is one and (we believe) to re-open discussions on its funding role for GeoNet. This is discussed further in this report.

Overall, the Panel considers that the current work plans are sufficient in terms of current resources. GeoNet represents a good design, shaped by good research that is being well managed under challenging circumstances. But to the question "Does the network in its present design configuration and scientific support meet requirements for a best-practice national monitoring capability?" the answer must be broadly "no". There will certainly be useful products from GeoNet but further development is required for it to achieve its full potential. However dealing with this question requires a broader look at the nation's needs for hazard monitoring. We deal with this in the next section.

While the first three years have been dedicated to implementation challenges, GeoNet has made a significant improvement in national capacity for earthquake detection and capability, volcano surveillance and slow ground deformation. The placing of all GeoNet obtained data in the public domain is of immeasurable benefit to all users in New Zealand and internationally as well.

Summary

In summary the Panel's opinion is:

- GNS has satisfactorily met its obligations for the GeoNet Project as set out in its contract with EQC.

- GNS management and staff assigned to the GeoNet Project have shown sound judgement in their decisions guiding network implementation, supporting research options, and the management of data outputs and their availability. The integration of research into decisions that guide network design, operational deployment, and outputs is exemplary, and must be maintained. This model is critical for success. Experience in other countries, such as the United States, has demonstrated that a close coupling of hazard research and hazard monitoring is essential.

- The initial funding shortfall and uncertainties for research funding has brought compromise to Project implementation and will certainly prevent the full success of the Project as first envisaged and as needed to contribute to risk management in New Zealand.

- GeoNet will continue to benefit from input from national and international expertise. Such input should include representatives from universities, regional councils, and from the disciplines of seismology, geodesy, and hazard reduction.

- The placement of GeoNet data in the public domain provides benefit to all users in New Zealand as well as internationally. This commitment to the public good is commendable.

Recommendations

- That the weak-motion, strong-motion and geodetic networks be deployed as originally planned in March 2000 to enable reliable detection and location of earthquakes anywhere in New Zealand and to allow rapid production of an instrumental "ShakeMap" within 30 minutes of an event.

- That the Earthquake Commission gives effect to (above) by increasing its funding support for the GeoNet Project to the level originally proposed in March 2000.

- That GNS continues to engage national and international expertise to provide ongoing comment on the design and operation of GeoNet.

- That New Zealand develops a formal plan for coordination of research efforts after major events. Such a group might include the role of GNS/GeoNet staff, university groups, LINZ and others.

TERMS OF REFERENCE 2 – NATIONAL CAPACITY

Objective

To assess the overall needs for viable national capacity for geological hazard research and optimal contribution from current and planned investments in the GeoNet Project.

This objective is to address a funding problem for GeoNet operations, and volatility in the levels of contestable public research funding, the balance between operational and long-term research and the uncertain institutional accountabilities for stewardship of basic capacity and direction. These issues influence the ability of any New Zealand institution to exploit the growing volumes of high-quality data for national benefit.

Comment

What constitutes a cost-effective natural hazard monitoring and modelling system clearly depends on perceptions of risk from natural disaster and what can be done, with the information available from monitoring and prediction, to both strengthen New Zealand's built environment against future disasters and to respond quickly and effectively when they occur. There is no obvious cost-benefit formula for making these calculations. When governments, business and individuals have to make decisions, such as to incorporate more earthquake resistance in buildings or invest more heavily in early warning systems, they have to trade off a certain present cost against a highly uncertain future benefit.

Quite obviously, too, public perceptions of risk are influenced by the fact that very few people have been harmed by an earthquake within living memory and virtually nobody by a volcanic eruption. Local government representatives made it clear to us that their priority was to mitigate hazards such as landslips and floods, and that earthquake risk was barely on their radar. Only two regional councils have thought it worthwhile to invest in volcanic monitoring. None are prepared to contribute significantly to earthquake monitoring. GeoNet is not alone in struggling to convince decision-makers of the value of being prepared for these risks. LifeLines and MCDEM have experienced similar problems.

The scientific opinion is that New Zealand is a long way from receiving diminishing returns from natural hazard research. By any measure New Zealand – the whole of it – is a highly active geological zone and this presents significant future risks to its built environment and to human life and limb. Major threats include the Alpine fault, an earthquake in the Wellington Region, the east coast subduction fault and a major volcanic eruption on the North Island.

A less scientific but more policy-based argument for giving a higher ranking to geological hazard mitigation are the requirements of the new national hazard management framework. Only now, through the impetus of the Civil Defence and Emergency Management Act 2002, is central and local government beginning to take a systematic

approach to understanding and preparing for hazards. The requirements of the Act for preparing responses to each major hazard will be informed by information from GeoNet and its products derived from GeoNet information.

GeoNet can assist local government to define earthquake and volcanic risk more precisely. RiskScape, a joint project of GNS and NIWA on the one hand and local government on the other, is dependent upon GeoNet and other data to build and improve probabilistic hazard models that can deliver reliable estimates of risk. RiskScape will trial a detailed mapping of the risks posed to the built environment in three local body areas from a range of natural hazards, including earthquakes. MCDEM is looking to GeoNet to provide "Shake Maps" that provide precise information about the location and severity of specific seismic events.

Such comments however should not be construed as seeking an open chequebook for research and monitoring. Rather, there is a management imperative for both GNS and EQC to make good decisions on wide ranging and changing priorities with limited funds. Contestable funding strategies provide control over the quality of and outputs from research activities. Sound programme performance reviews by FRST and EQC and good contract management by GeoNet clients are also critical.

Furthermore, there is a policy need to develop practical management tools for either defining "how much research is enough" or understanding how uncertainty should be treated in terms of the available data and information. We can expect that we may never have sufficient information for some decisions so these must be made on what is available, and we need to understand the uncertainty around such decisions. Presumably as we understand more about hazards and their risks, these uncertainties will reduce.

What Role does this give GeoNet?

We start from the premise, therefore, that New Zealand needs at least to maintain and probably to increase the planned quality of its ability to assess and respond to earthquake and volcanic hazards. There are three possible scenarios, expressed in terms of funding constraints.

1. Worst case.

   On the present funding profile over the remaining years of the EQC contract, and assuming the run-out of a further tranche of the remaining FRST funding over the next two years, GNS and EQC would need to reassess their ability to maintain GeoNet's present capability. The scientific members of the panel were strongly of the opinion that the present backbone should be completed as a matter of priority, to ensure a basic minimum coverage of the whole of New Zealand, and particularly along the Alpine fault. Extending the network not only incurs capital costs but adds to GeoNet operating costs. The implication seems to be that if the planned network is not to be compromised, the losses would occur in the capability to add value to network data.

2. Complete network to original specifications and ensure that value-added products can be produced.

   This option will require a significant additional capital injection for GeoNet and an increase in its operating budget for network maintenance. Further increases have been identified as the incremental costs of staffing to sustainable levels, to increase coverage and monitoring data management functions, and some added value products (required to receive timely data during an event). This is the $2M missing from the original proposal. The uncertainty surrounding these funds needs to be quickly resolved.

3. Increase the density of the network.

   The view was expressed by our scientific members that some products being expected from GeoNet, such as detailed "Shake Maps", could not be produced accurately without a greater network density. This would require a further injection of both capital and operating costs. We are not in a position to cost this option.

The panel's conclusion was that, at a minimum, funding must be provided to complete GeoNet to its original design of March 2000.

Full value for investment in GeoNet can only occur when all aspects of hazard management are integrated across government sectors. EQC can best protect its investment in GeoNet by engaging in discussions around this imperative.

Funding GeoNet Scientific Capability

As far as GeoNet is concerned, the main issue is not its continued operation of the network but to what extent it should be funded for data analysis and modelling and basic supporting research.

The Panel believes that GNS management has made good choices on the required research objectives and in ensuring that these are of international quality. The influx of young and able scientists is due partly no doubt to the intellectual leadership provided by the international reputations of the GeoNet-associated GNS scientists but also probably to the opportunity to work closely with a significant research instrument – the monitoring network. The synergies therefore from having the science closely connected to the network are significant. Conversely, good quality research helps shape the network and its outputs.

The other major source of geophysical research in New Zealand, the universities, appeared to agree with this conclusion and its implications: that the GeoNet Project includes the capacity to develop useful models from the data and the research that underpins those models; and that this in turns requires the maintenance of a high-quality scientific staff. We only spoke to the relevant Professors at Victoria and Canterbury, but they both warmly endorsed their relationship with GeoNet staff and

gave every impression that its value lay in the quality of that staff and its scientific capabilities, as well as access to the monitoring data.

We consider it absolutely essential that good science and development in support of the GeoNet project is continued. Therefore, an agreed amount of negotiated research funding for GeoNet must be secured (with normal quality controls in effect), otherwise the design of the network and its outputs will be compromised (against the Project's full potential).

This does not mean that GNS should have a monopoly on research funding. Higher-level research, such as modelling and forecasting work, necessary to transfer GeoNet outputs into public good and business decisions, must remain contestable. There is no disagreement about this, including from GNS management. To ensure that GeoNet's research is focused on its primary mission, the Panel recommends that EQC and FRST, as the two principal research funders, jointly discuss GeoNet's internal research needs and the modelling and forecasting work in the context of GeoNet's annual work plan for EQC and funding proposals to FRST.

GeoNet and the National Risk Management Spectrum

The Panel noted that not all Central Government funding decisions are supportive of risk management building blocks such as GeoNet. The Panel noted several instances where commitment appeared lacking and where decisions on risk management were made in isolation of the overall need.

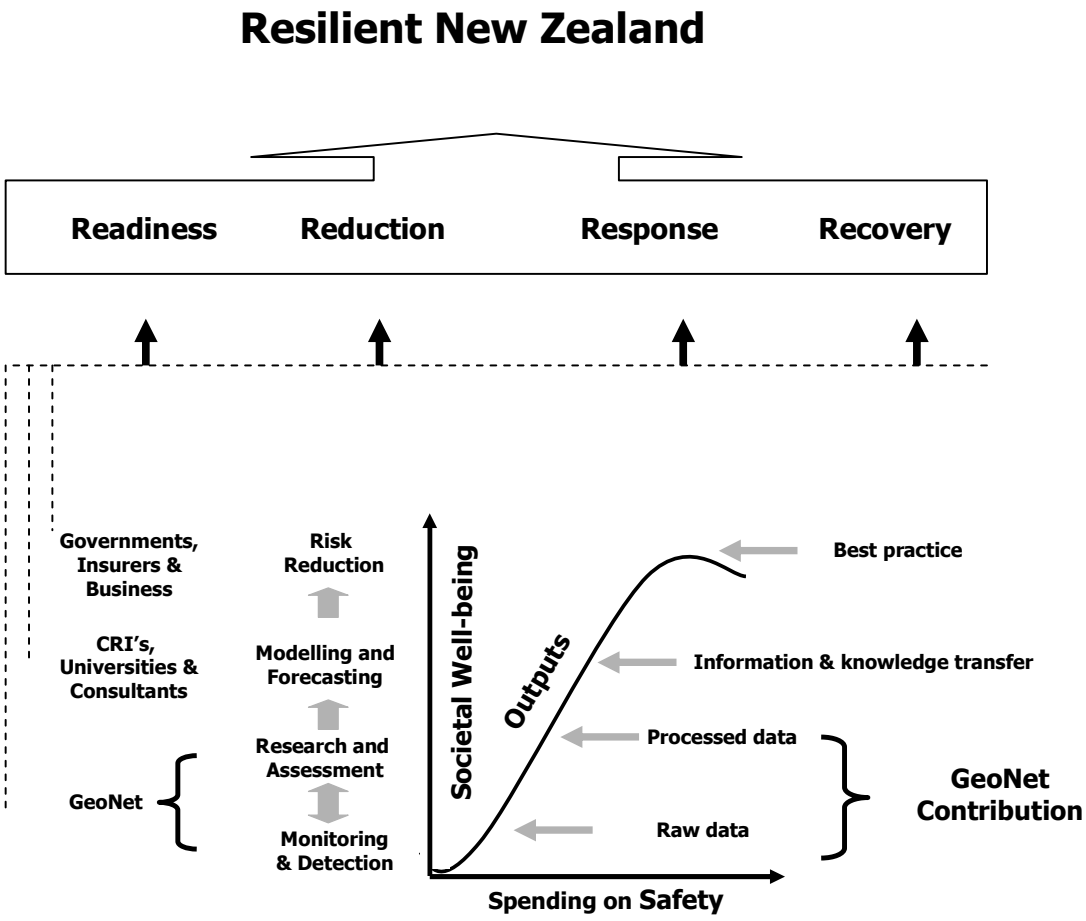
Local and central government have quite different expectations of each other and of GeoNet. Even within central government the (potentially) contributing agencies are not co-operating to the likely extent needed to provide a coherent framework for risk management. There is a continuing need to manage risk in an integrated manner, from understanding hazards to assessing risk, then propagating this knowledge through the much vaunted "4R's", and finally setting policies for resilient communities. It seemed incongruous to the Panel that this "integration" is not being managed cooperatively by the two levels of government. The commitment to the natural hazard end of the risk management spectrum, where GeoNet is placed, can be improved in both local and central government.

Local government clearly stated that natural hazards are low, indeed, very low on their "issues radar". Producing high quality and appropriate data and information products through GeoNet makes little sense if local government is not committed to and competent in hazard and risk assessment and management. And of course if central government cannot commit to ensure research funding necessary for GeoNet optimisation, then local government will not have the data and information they require. Both levels of government should ensure they have sufficient internal capacity to meet their respective needs and to ensure effective dialogue between.

Reducing uncertainties around hazards and risk is a national issue of paramount importance. Uncertainty is expensive at all levels, for example in the insurance industry where individual premiums are set with respect to built assets, and nationally when

determining the best response to a large-scale emergency/disaster. The lack of understanding of earthquake/volcanic risk, and of the uncertainties around estimates of probabilities and return periods, is endemic and potentially expensive to the nation.

The placement of the GeoNet Project within a national risk management framework is illustrated in the following figure.



Summary

In summary the Panel's opinion is:

- That New Zealand is not fully taking advantage of its investment in infrastructure if it does not adequately fund the development of higher level products and research that could come from GeoNet.
- The "national" capacity of GeoNet is threatened by the current funding restrictions and volatility.

- Research funding for GeoNet support should be non-contestable to ensure proper network development and appropriate data and information outputs. Beyond this crucial requirement, research funding for such activities as forecasting and modelling must be contestable for all.

- The value of GeoNet can be maximised through participation in a large, national framework for risk management where roles and responsibilities are clearly set out. Financial contributions should be rationalised on some agreed basis that reflects these respective roles within the framework.

Recommendations

- That an agreed, appropriate level of non-contestable research funding to support GeoNet be secured through FRST over the length of the contract.

- That the Earthquake Commission engages in discussions with other government sectors with a view to participating in an integrated approach to risk management within which to effectively situate their GeoNet investment. These discussions should be in parallel with the completion of the fit-for-purpose GeoNet functionality to the agreed original scope (March 2000).

- That the Earthquake Commission's oversight of the GeoNet Project be strengthened to ensure:

  - A proper balance between monitoring and supporting research priorities.

  - That the GeoNet Project is effectively linked to the broader strategy for risk management in government and private sectors.

- That GeoNet and EQC prepare a fall back position should base funding prove insufficient. As the existing investment in GeoNet should not be compromised, expansion of the network would be curtailed to secure a sustainable operating budget and added value analysis of information deferred indefinitely.

TERMS OF REFERENCE 3 – FUNDING MODEL

Objective

To devise a framework for meeting the cost of GeoNet, aligning responsibilities and funding ability with *measurable* benefits which contribute to risk management at local and national levels.

This objective is to re-evaluate the GeoNet program goals against broad socio-economic objectives of Government. The context is legislation that among other things empowers the Earthquake Commission to fund GeoNet and facilitate research, and other legislation that introduces new expectations of civil defence and emergency management at all levels of government and commerce, with increased focus on preparation, mitigation and recovery planning.

Comment

The argument for the split between public and private funding is not simply where public good ends and private benefit begins. The information from GeoNet is not a pure public good: in some forms it could be sold to individuals for their private use. Most funding models assume that one-off research studies or monitoring projects can be contracted between GNS and clients such as local government, private enterprises and State Owned Enterprises (SOE's) on a need basis. Some market research to clarify private sector and SOE funding opportunities would be timely.

But it is hard to see that user-pays funding would be an acceptable solution to the government for most of GeoNet's products. The panel's basic conclusion is that the event monitoring network and the basic information obtained from it should be treated as a public good and largely funded from public revenues. Nevertheless certain groups of users receive specific gains from products developed using GeoNet data and its products in terms of their ability to better manage risk or discharge their mandates. This principle of distributed benefits should be a starting point for seeking contributions to GeoNet costs.

There is however no exact formula for relating revenue contributions to benefits and there needs to be either a voluntary agreement amongst the main public funders or a government directive on what their respective shares should be. Given EQC's dominant funding role, there is potentially a "free rider" problem that needs to be overcome. The following discussion accepts that somewhat pragmatic reality.

Stakeholders and potential benefits include:

Stakeholders	Areas of Potential Benefits
EQC and private insurers	Premium allocation and reinsurance

Public and private utilities	Structure hazards
Ministries (MCDEM, MfE)	Hazard and emergency management policy development and assessment
Emergency response organisations	Response priorities and risk
Local government	Wide spectrum of management responsibilities (including hazard identification, policy development and planning decisions, consents and compliance, and civil defence and emergency management)
Major asset owners	Opportunity to reduce insurance premiums through improved knowledge of geohazard risk.
Public good (represented by EQC's research and education mandate and FRST and other pooled research funding)	Better general understanding of NZ's geology and the risks it creates for human activity
Homeowners	Emergency preparations, informed financial decisions (insurance, purchases of major assets, etc)
Universities	Generation of knowledge and human capacity

Possible Sources of Additional Funding

Earthquake Commission

We are assuming that EQC funding for GeoNet would continue on the present basis, and that EQC, subject to premium income constraints, would consider an increase to its original funding commitment. This would probably at least complete the present "backbone" network and allow consideration of further enhancements to give better sensing in particular risk-prone regions.

Foundation for Research, Science and Technology

There was no definite commitment from FRST to reconsider its funding of GeoNet, but we gained the impression that FRST was ready to re-open discussions with GNS management on this subject. The Panel was made aware that in the original agreement relating to GeoNet the existing FRST funding into geological hazards monitoring was to

be shifted to support GeoNet research requirements (with EQC monies supporting the monitoring activities). GeoNet planning was clearly based on this agreement. Subsequent decisions taken at FRST reference groups have compromised this tacit agreement, the progress of GeoNet and its potential. In this regard the Panel was pleased to learn that the issue of national capability was being reviewed in MoRST and FRST and strongly urges that a national policy be enunciated that provides a clear signal of support for public good monitoring programmes. We encourage this important issue to be resolved as soon as possible and within the context of an integrated risk management framework for New Zealand. This we see as an issue to be resolved if necessary by the Department of The Prime Minister and Cabinet.

FRST funding would be appropriate for the research required to direct monitoring network design and output developments. But whatever the level of FRST's commitment, it needs to be with sufficient certainty of continuity to enable GeoNet management to make staffing commitments. As noted above, FRST and EQC funding should come with management oversight of detailed research priorities to ensure quality and relevance. FRST funding for other research (such as modelling and forecasting) should continue to be allotted through a transparent contestable process. GNS can and should compete here, as others must.

Ministry of Civil Defence and Emergency Management

The most appropriate vehicle for increased direct government funding would be MCDEM. An estimated $1M/yr benefit accrues to the Civil Defence sector from GeoNet. This is the rapid response function of GeoNet, meaning telecommunications systems to support data and the duty officers on call at each of the twinned data centre (and overhead support). The Panel understands that MCDEM has unsuccessfully sought money under the normal budget processes to support GeoNet. This is another example of fragmented decision-making disrupting the critical connection between data and information, and risk-based decision-making for resilient communities. The expectations on GeoNet are set out in the National Civil Defence Plan for New Zealand

Utilities, SOE's, and Major Asset Owners and Insurers

Prior to the establishment of GeoNet, GNS experienced a negative reaction from local government and utilities to requests for funding. However, GeoNet is now up and running, providing much greater leverage in such discussions. Assuming base funding sourced from central government, GNS needs to be more proactive in seeking needs based funding from state-owned enterprises, major asset owners, insurance companies, and utilities in return for providing critical hazard alerts and tailored science and management information. In particular, there appears to be considerable scope for GNS to approach major asset owners and offer hazard risk information to enable them to negotiate lower insurance premiums for their assets.

Regardless of whether it is selling individual tailored products to specific users or engaging in negotiation and persuasion with groups of users, it is important that GNS develop its own marketing plan. It is important that the marketing efforts of GNS bear fruit. Given the substantial government investment in the network, the development and public and private sector use of added value products from GeoNet serve to reinforce

the practical value of the network. This is turn will serve to validate both the original investment decision particularly given that it was a somewhat contentious one, and the proposal in this report that the full network be completed as originally conceived.

Local Government

The Panel was concerned about the implications of the position advanced by Local Government New Zealand and echoed during the Regional Council interview. LGNZ said that natural hazard management was very low on its "issues radar" (citing an array of "downloaded" responsibilities and costs arising from, for example, the new Local Government, and Civil Defence and Emergency Management Acts). Their expectation was that GeoNet was a national contribution and one that should not expect financial contributions from ratepayers. Another expectation was that GeoNet deliver information that is ready and fit for local government use, rather than science based reports that would require further resource commitment to translate into council processes and decisions, and where Councils are unable to address the content of these reports, would increase council liabilities through inaction.

While appreciating these perspectives the Panel were firmly of the view that this is an unacceptable situation. Communities need to be protected and their well-being must not be compromised by a lack of agreement between central and local government, nor by local government failing to resource themselves appropriately to interpret and use important geohazard information. The two levels of government need to commit to finding a solution so the important data and information on natural hazards can flow unrestricted between them.

The Panel holds the view that it is not appropriate for local government to contribute funds for the national public good aspect of GeoNet. This view is in recognition that Councils have their own local suite of natural hazards to address, as well as their delegated emergency management responsibilities to manage. These form part of the national risk management framework discussed previously. However, where local government requires special geohazard services to add value to their specific responsibilities then they can be expected to fund those from rates. While GNS does not and should not enjoy a monopoly for such contracted work the Panel expects it to compete vigorously for the work.

Marketing and Stakeholder Strategies

Even more important than *a marketing strategy* by GNS for services and products beyond GeoNet is the requirement for *a stakeholder strategy* for EQC's GeoNet-based interests. This is essential for achieving an increase in funding from multiple sources.

First, to be successful in securing funds and for ensuring that the outputs of GeoNet are properly contributing to risk management decision-making (and why would they be funded otherwise?) a clearly defined strategic framework for natural hazard management is required. This is needed to establish the principle of contributions to various elements of the framework – across the 4 R's – by the different stakeholders discussed above. This should include a decision, if necessary from government, on how

the costs of the hazard mitigation/research outcomes should be shared out. Part of this decision must be the recognition of respective central and local government roles and responsibilities.

Second, it seems appropriate that the best approach to managing this framework and its funding strategies is via an inter-agency (government and private) stakeholders committee led by EQC under the aegis of the Natural Disaster Fund. As this committee can have only a coordination function, it will have to rely on any necessary authority and accountabilities being exercised elsewhere. As EQC Board reports directly to the Minister of Finance this should serve to entice cooperation from stakeholders.

Without the framework noted above this committee is likely to be ineffective. The suggestion mirrors that made by the June 2000 FRST policy review of the original GNS (GeoNet) proposal identifying the need for "an advisory group, representing the wider stakeholders, to enhance the implementation and development of, and participation in, the network, and that this group assess, in the first instance: the human resource capability to support the network, particularly during an emergency event; the form in which data and information will be produced (page2)."

Summary

In summary the Panel's opinion is:

- The basic GeoNet funding model is appropriate but the relationships with stakeholders and clients require increased attention.

- The stakeholder relationships for GeoNet services and outputs are best managed nationally through the Earthquake Commission.

- The Institute of Geological and Nuclear Sciences Ltd. requires a marketing strategy to maximise the opportunity for extending GeoNet outputs to prospective clients in both public and private sectors.

Recommendations

- That discussions begin immediately with government on how the costs of the hazard mitigation and research outcomes should be shared.

    - That as part of the solution arising from these discussions a long-term commitment of research funds (to direct the network and to develop its outputs) be established through FRST.

- That, once the outcome of the preceding initiative is known, an inter-agency stakeholders' committee be established through which the research and other outputs and expectations of GeoNet can be more precisely specified and agreed. Such as process could be managed through the Earthquake Commission, the Ministry for Civil Defence and Emergency Management or via a research consortium

- That stakeholders include local government, universities, other government departments as identified, emergency services, and public and private utilities.

- That the Earthquake Commission's oversight of the GeoNet Project be strengthened to ensure:

  - Effective relations with stakeholders including reinforcing the value of GeoNet in hazard mitigation and research and support for stakeholders' use of GeoNet data and products. The continuation of the GeoNet brand will be important to promote the public good aspects of the Project.

  - That the FRST/GeoNet research funding decisions are consistent with a national risk management framework.

  - That research funds are allotted to developing practical management tools for defining "how much data and information is enough" for providing direction to GeoNet, and for understanding how uncertainty around decisions should be treated in terms of the available data and information.

Appendix Panel Members

Terry Day - Principal, TJ Day Associates, BA, MA, (British Columbia), Ph.D (Cant.)

Before establishing his present consultancy, Terry Day was CEO of West Coast Regional Council and before that a senior manager for Southland Regional Council (both in South Island, New Zealand). In earlier years abroad he acquired extensive experience of science institutions and environmental monitoring in Canada, first as a research scientist, and later in policy and senior management roles for Environment Canada. Terry's experience in New Zealand permits him to understand local government legislative and management processes, and central government policy impacts on local hazard management, community awareness and attitudes to hazards, the role of CRI's, universities and regional councils in science management and relationships amongst councils on significant national and regional issues

Rob Laking - Senior Lecturer, VUW School of Government, BA(Hons), MPA (Harvard)

Rob Laking is a former senior New Zealand public servant and specialist in advice and capacity building in governance, public management and financial management. Rob left the public service in 1995 after four years as Chief Executive of the Ministry of Housing. From 1964-86 he worked in the New Zealand Treasury on a wide variety of assignments including government debt management; social policy development; energy, industry and primary resources policy, reform of public enterprise and financial management reform. He has also served as Deputy Director-General of Social Welfare and as Assistant Commissioner responsible for performance reviews of government departments and chief executives for the State Services Commission. He led the project team for the review of New Zealand's state sector reforms in 1991.

David Miller - Principal, Vantage Consulting Group, BA (Waik), BBS (Mass.), MA (Cant.)

David Miller is a founding director of Vantage Consulting Group, a Wellington based business consultancy. He has undertaken assignments for the Foundation for Research Science and Technology relating to industry-based research consortia, and for Crown Research Institutes, and New Zealand Trade and Enterprise on funding decisions to assist industry. From 1994 to 1998, David was Commercial Advisor to the Minister of Finance of the New Zealand Government, and in earlier years worked in consulting, investment and banking, strategic planning and research.

Yoshimitsu Okada - Director of Strategic Planning, National Research Institute for Earth Science and Disaster Prevention, Japan, BS, MS, D.Sc (Tokyo)

Yoshimitsu Okada has led national research teams in studies of earthquakes, volcanoes and their impact on society. He combines scientific leadership with long service to public science policy and management in Japan, being a member of several committees for the Japan Science Council as well as national and international committees for natural disaster mitigation. The latter include the Council for Disaster Mitigation, Tokyo Metropolis, and the Panel on Earthquake Research, United States-Japan Conference on

Development and Utilization of Natural Resources. His department at NIED is responsible for guiding the design and conduct of a wide range of research on earth and atmospheric processes to develop mitigation strategies for community planning.

William Prescott - President, UNAVCO Inc., BA, MA, Ph.D (Stanford)

William Prescott is a distinguished scientist with substantial experience of the initiation and construction of geophysical monitoring networks. He is a former Chair of the Southern California Integrated GPS Network (SCIGN) and a former National Earthquake Hazards Program manager with the US Geological Survey. He is now President of UNAVCO, a consortium with more than 50 university members world-wide. UNAVCO provides planning and management of activities benefiting the solid earth research community. UNAVCO is responsible for constructing the Plate Boundary Observatory, a component of EarthScope, a National Science Foundation-sponsored study of the North American continent. The Plate Boundary Observatory is a network of similar design to GeoNet but spanning the western seaboard of North America, from Alaska to Mexico.