

Slope Stability & Landuse

Improving Planning Practice



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*A report commissioned by the New Zealand Earthquake
Commission under its 'Science to Practice' Programme.*

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Terminology used in this report

The main focus of this report is on slope stability. Slope stability does not necessarily constitute slope failure. In contrast, the terms landslide or landslip, which do constitute slope failure, are often used interchangeably.

The term landslide refers to “the movement of a mass of rock, debris or earth (soil) down a slope” (AGS, 2007a). The term ‘natural landslip’ is a term defined by the Earthquake Commission Act 1993 as “the movement (whether by way of falling, sliding or flowing, or by a combination thereof) of ground-forming materials composed of natural rock, soil, artificial fill, or a combination of such materials, which before movement, formed an integral part of the ground; but does not include the movement of the ground due to below-ground subsidence, soil expansion, soil shrinkage, soil compaction, or erosion.”

In this report the term landslip is used in preference to landslide when referring specifically to slope failure, the exception being when referencing other documents that use the term landslide.

PREFACE

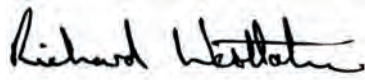
An essential element in determining whether land use planning and consenting processes meet good practice expectations is the degree to which professional knowledge and institutional processes are aligned. Participants in the planning process need to be aware of the critical points for intervention and their respective roles in managing relevant knowledge and its application to decision outcomes.

This study has taken an important step in trying to delineate where that balance might lie and in building a “process map” of the steps and factors influencing consented land use activity as applied to landslip prone land. Through this approach the study team has set out to demystify professional practice and to provide practical suggestions for improving current approaches to slope stability risk assessment in New Zealand.

The lessons are simple; improved information sharing, better communication about potential hazards and new frameworks that extend accountability to those best able to manage the risks of inadequate assessment or ill-informed action. In drawing together the experience of a wide range of practitioners and the experience of two territorial authorities this study offers an objective view of the issues that New Zealand faces in planning future land use in the presence of natural hazards.

Adoption of the study recommendations would undoubtedly contribute to more effective management of slope stability risk and the advancement of professional practice in this area.

I commend the report to you.

A handwritten signature in black ink, reading "Richard Westlake". The signature is fluid and cursive, with the first name "Richard" and last name "Westlake" clearly distinguishable.

Richard Westlake

Chairman Standards New Zealand

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EXECUTIVE SUMMARY

The New Zealand Earthquake Commission (EQC) provides national disaster insurance to residential properties throughout New Zealand. This includes damage caused by landslips. EQC exposure to natural disaster claims arising from landslips is significant, for example amounting to some \$18 million in the 2008 year, with an average annual cost over the last five years of \$16.6 million.

As part of its active role in advancing New Zealand resilience to natural disaster damage, EQC supports research and education about matters relevant to reducing natural disaster damage, and in particular the adoption of relevant new research by practitioners. Thus, whilst not an EQC issue alone, the Commission saw advantage in bringing a study together to address the quality of decision making for the use of landslip prone land and, in particular, to give consideration to improving land use planning practices for those parts of New Zealand where slope stability is a significant problem.

This study, undertaken by the New Zealand Centre for Advanced Engineering (CAENZ), adopted a two-fold approach to researching current land use practice, and comparing this with what may be considered good practice. Firstly, documentation held by two case study councils, Far North District and Hutt City, was examined in order to ascertain the influence that available tools and their application have had on improving professional practice and, second, a series of surveys and workshops were held in order to provide context to the relationships between the different disciplines contributing to the land use decision process.

The lessons from these two work streams have then been synthesised into a 'process map' illustrating how slope stability information gets incorporated into the decision-making process, and the ways in which these sources of information can contribute to improved understanding and a higher quality of decision making.

Key findings of this study are that:

- There is a view that all land can be safely engineered to make it suitable for development. This view is not consistent with reality;
- While the understanding of how to reduce landslip risk has increased over time, many professionals employed by developers and councils have not kept up with these advances;
- Geotechnical information pertaining to various regions is held by a number of organisations without all parties being aware of, or having access to it;
- Accountability for ensuring effective decision-making methods of the consenting process does not always lie where the advice that the process depends upon is given;
- A raised awareness that slope stability is an issue, and improved education and information sharing, is a prerequisite to improved land use planning.

Observations made by the project team during the course of this study, and direct contributions from planners and related professionals through the workshops and survey have identified a range of opportunities for improvements to the planning process. Foremost amongst them is the need for an integrated approach to the problem and better coordination to improve communication and collaboration. Recommendations are made for both near term and medium term implementation.

The recommendations focus on three key areas for action:

- Improved information sharing;
- Raising the profile of slope stability risk, and;
- Extending accountability.

Adoption or action upon these recommendations is not the responsibility of any single organisation or profession. Instead the report suggests a framework for going forward that encourages all stakeholders to take a proprietary interest in dealing with and improving approaches to slope stability risk throughout the country.

1. INTRODUCTION

“Experience shows that despite engineering solutions, natural processes ultimately determine whether a structure and the land it stands on fails or not. Determining the balance between allowing people to develop or use land and restricting their exposure to natural hazards in a sometimes rapidly changing landscape is complex” (CAENZ, 2007).

1.1 Background

Slope stability is an issue for many parts of New Zealand. Steep slopes, tectonics and rainfall are the main causes of slope failure. However, the vulnerability of the land to slope failure can be increased by inappropriate use; thereby exposing people, property, and infrastructure to increased risk.

Landslips, the result of slope failure, represent one of the most frequently experienced natural hazards in New Zealand. Last year alone, the Earthquake Commission (EQC) received over 1300 landslip natural disaster claims (Earthquake Commission, 2008).

This study extends upon two previous studies that addressed the improvement of practice in the management of landslip risk; (Riddolls & Grocott Ltd., 1999), (CAENZ, 2007). Like these previous two studies, this study was commissioned by EQC as part of its active role in advancing New Zealand’s resilience to natural disaster damage.

The focus of this study is to understand how slope stability is considered in current land use and planning practice.

For the management of landslip risks to be improved, it is necessary to have an understanding of how actual planning practice is influenced by considerations of slope stability. The need to consider natural hazards in land use planning is well recognised. However, the degree to which such knowledge is translated into effective land use planning is commonly acknowledged to be variable. Gaining a greater understanding, therefore, of why practice varies provides useful insight into

opportunities for improvement and ultimately; will lead to a reduction in the exposure to landslip risk.

In reviewing land use planning several statutes need to be considered. Each can be linked through the Regional Policy Statement from which are devised both Regional and District Plans (as shown in Figure 1). And thus, how these statutes are interpreted in the appropriate plans adds to the complexity of addressing slope stability through normal land use planning channels. These can be differently applied across the country.

Of these statutes, three feature prominently:

- The Resource Management Act 1991 (RMA) has as its purpose to promote sustainable management of natural and physical resources. Under the RMA, local authorities are tasked to control land for the purpose of avoidance of natural hazards and control the actual or potential affects of land use through the avoidance of natural hazards.
- The Civil Defence Emergency Management Act 2002 (CDEM Act) was written as a result of reviews of the 1983 Civil Defence Act, in part so as to ensure the effective management of all hazards facing New Zealand. This includes the reduction of risk exposure.
- The Building Act 2004 outlines requirements¹ for the construction of structures. Protection from, and not worsening the effect of natural hazards are considered as part of these requirements.

¹ Sections 31-39 detail requirements of project information memorandum (PIMs) and that special features, including natural hazards are included (Section 35) as information relevant to proposed building work. Under Section 41 an exemption to the requirement to obtain building consents may be applied to urgent work such as could occur following a natural hazard event if it is for the purpose of saving or protecting life or serious damage to property. Sections 71-74 of the Building Act 2004 detail the limitations and restrictions on building consents: Construction of building on land subject to natural hazards. Once an event has impacted a building it may be subject to requirements under subpart 6 of the Act - Special provisions for certain categories of buildings addresses dangerous, earthquake prone and insanitary buildings, with Sections 121-123 defining these categories of building, while Sections 124-130 provide the powers of territorial authorities in respect of dangerous, earthquake-prone, or insanitary buildings. Sections 131 and 132 provide the requirements for policy on dangerous, earthquake-prone and insanitary buildings.

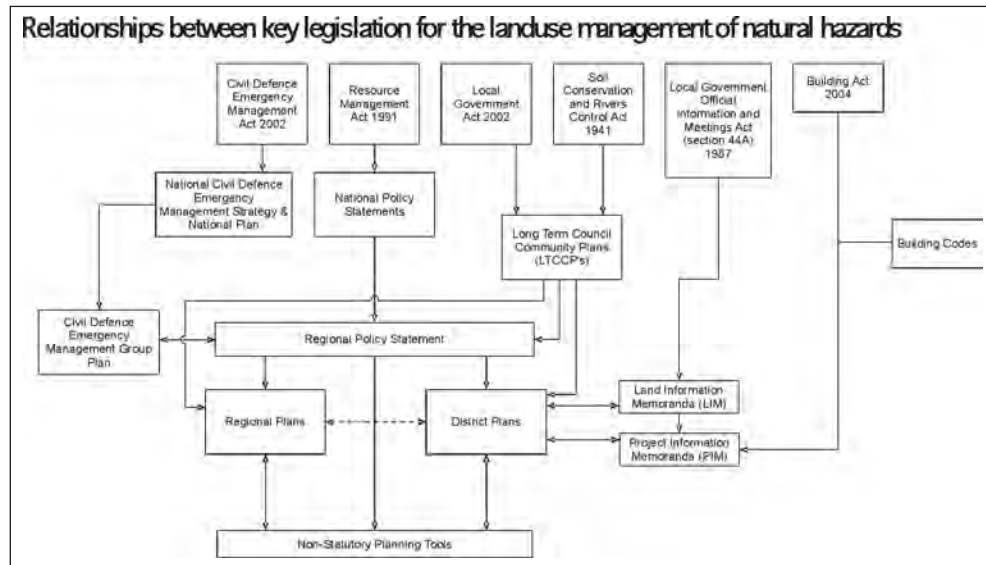


Figure 1: The complex relationships between legislation for managing natural hazards. From Saunders and Glassey, 2007

Collectively these Acts place a significant duty on local authorities, and others, to apply rigour to land use planning where natural hazard risk is present.

Local authorities implement these requirements through Civil Defence Emergency Management (CDEM) Group Plans and Long-Term Council Community Plans (LTCCPs). It is imperative that sound risk reduction policies are prominent in these plans. Consistency between CDEM Group Plans and the LTCCPs is crucial to the implementation of successful reduction measures. Recognition of this requirement has led to a number of studies and guidance documents within the last decade.

The following is a brief summary of studies that have improved and informed planning for slope stability in recent years.

- Assessment of Geotechnical and Development Factors involved in EQC landslip Claims* (Riddolls & Grocott Ltd, 1999) was an EQC commissioned study of the geotechnical and regulatory aspects of landslip risk. This research found that 40% of the landslip claims analysed involved slopes that had been modified by engineering works. It also identified some deficiencies in both professional practice and local government regulatory control of the building consent process. The study offered a possible process for the systematic administration of building approvals.
- Planning for Natural Hazard Risk in the Built Environment* (CAENZ, 2004) addressed key factors and considerations deemed to be important for good decision making around natural hazard issues. In particular, the report identified issues such as storage of, and access to, publicly funded information and the capacity for improved interaction between local authorities, science providers and other experts. This study emphasised the importance of ensuring that qualified expertise, sound processes and readily accessible data and information are used to inform decision-making.
- Managing Landslip Risk: Improving Practice* (CAENZ, 2007) was a broad based study commissioned by EQC, that extended upon the earlier work. It identified how current investments and practices in landslip risk management could be improved across the range of government, private and professional organisations involved. A suggested integrated risk management framework (Appendix 1) that could allow all participants to better approach landslip risk assessment and mitigation was proposed. The report stated the need for a collective approach involving EQC, councils, knowledge providers, professional associations and consultants.
- Concurrently with the CAENZ 2007 study, GNS Science released its *Guidelines for Assessing Planning Policy, and Consent Requirements for Landslide Prone Land* (Saunders & Glassey, 2007), commonly

referred to as Landslide Guidelines. The Landslide Guidelines are primarily targeted at assisting planners in determining if existing planning documents appropriately incorporate landslide and slope stability hazards.

The Landslide Guidelines and Managing Landslip Risk: Improving Practice (CAENZ, 2007) are complementary; both defining elements of good practice. They do this through frameworks, offering examples and describing the characteristics of slope stability considerations in land use.

In addition to these studies, several other documents have been influential in shaping current land use planning and related practices within New Zealand;

- The Australian Geomechanics Society (AGS, 2007a) give specific guidance on risk zoning and land use planning. They have also produced a *Practice Note Guidelines for Landslide Risk Management* (AGS, 2007b) to address slope stability for proposed developments in Australia; acknowledging that almost all local government areas (LGAs) are susceptible to some form of landslide hazard. These documents provide guidance for risk assessment and management to practitioners, and guidance about the interpretation of reports to government officers.
- The Ministry for the Environment (MfE) has provided guidelines on natural hazard risk management, including landslips (Quality Planning, 2006). This resource gives background information on a risk-based approach to hazard management, and provides an overview of the RMA tools that are available for managing natural hazards

1.2 Understanding the problem

What these documents do not provide is a perspective of how considerations relative to slope stability are actually being incorporated into land use planning decisions.

Understanding the different considerations that councils, certifiers, owners and others take into account in planning and developing policy for slope stability, presents a complex

and significant challenge. This complexity is compounded by the diverse use of statutory and non-statutory planning tools; such as structure plans, master plans, and growth strategies, as well as elements of the building consenting process and engineering practice notes that the various stakeholders draw upon.

This study attempts to map and quantify these considerations.

Understanding what is taking place now provides an opportunity to identify existing strengths and work towards addressing weaknesses as part of achieving better practice. Consequently the study sought to establish a methodology that facilitates benchmarking of current practice for comparison against recommended practice.

No single organisation or discipline owns slope stability risk. In addition to the range of documents already outlined, the different organisations and professions have different roles and draw upon different information in order to manage different aspects of slope stability risk:

- Territorial Authority (TA) District plans document strategies for addressing the risk of slope stability within a wider context of local authority goals.
- CDEM Groups, the regional consortia of TA's, maintain GDEM Group Plans in consideration of regional risk exposure.
- Consenting and planning departments within TA's manage the records relating to land use and development and are charged with both compliance and implementation of managed growth strategies.
- EQC has a historical record of landslip occurrences and contributing factors.
- Geotechnical and engineering consultancies often have their own records of geological features and slope stability vulnerabilities.
- Crown Research Institutes hold considerable slope stability data from across New Zealand in both electronic and paper records.
- Agencies such as Ministry for the Environment, Department of Building and Housing and the Ministry for Civil Defence and Emergency Management also hold specialist knowledge.

Each of these organisations and their resources contribute to the management of land use and slope stability, however, each one offers a perspective on only part of the overall picture. To be effective, the approaches that individual organisations adopt need to be complementary. In other words, what is needed is a systemic approach to characterise and distinguish the variations in approaches often taken by different organisations and disciplines.

To better define the problem, and for the purposes of this project, a study team that represented the diversity across the various organisations and disciplines concerned was brought together to assist in the analysis. The project itself focused on two territorial authorities that were actively seeking to address slope stability as part of their land use planning approach.

The question asked was - to what extent and effect slope stability considerations were influencing land use planning within these two Authorities? By understanding these influences, and testing them against the recommendations contained within the Integrated Risk Management Framework (Appendix 1), it was hoped that the study would lay the foundation for further advance of land use practice nationally.

1.3 Study Objectives

In seeking to present practical ways to improve planning for the management and use of land subject to slope stability, the study therefore sought to:

- Measure existing effectiveness of landslip risk reduction through land use planning,
- Identify barriers to good practice, and
- Identify examples where appropriate solutions to reducing those barriers have been implemented to reduce risk exposure.

In particular, the intent of this study was to:

- Determine practitioners' views on the use and effectiveness of existing landslip risk policy and practice;
- Present recommendations for practical ways by which planning for the management and

use of landslip vulnerable land might be improved;

- Identify barriers to good practice through participant feedback;
- Offer appropriate solutions to reducing those barriers in order to reduce landslip risk exposure;
- Assess anecdotal claims about current practice and the uptake of science into practice.

The study specifically sought to examine the roles of the following factors in affecting the quality of decisions for the use of landslip prone land:

- Perception of tolerable risk;
- Influences on decision making, including liability;
- Access to and use of technical information and resources;
- The impact of technical information and resources have on improving practice;
- Council capacity and capability to address slope stability through planning and consenting;
- Internal council processes that support decisions on land use;
- Awareness of, and compliance with, legislation and council policies;
- Knowledge sharing and interactions.

The two areas adopted for case studies were the Far North District Council and Hutt City. The case studies were developed in a way that would allow the work undertaken to be extended to include a larger number of local authorities in the future, if deemed desirable. The long term objective would be to produce a systematic national assessment of:

- Current capability with regard to policy and practice in land use planning for landslips;
- Sharing of opportunities and knowledge to improved practice.

Where appropriate, the Landslide Guidelines were used as a reference in determining the extent to which land use planning and consenting documentation met with good practice expectations.

2. METHODOLOGY

2.1 Approach

The approach taken in this study was both collaborative and inclusive. Rather than conducting an external analysis of practice, the various stakeholder disciplines were represented on the study team in order to draw upon the perspectives and knowledge of the different professions. This also assisted in identifying the extent of cross discipline interaction and communication that takes place during land use planning.

It was decided that although slope stability is often characterised differently for different geographic locations that two quite contrasting local authority areas selected would provide a valid perspective on the range of slope stability considerations that might be considered nationally. The two case study areas also represented contrasting populations; one council being urban and the other predominantly rural.

Representation on the project team was chosen so as to provide a wide range of knowledge of both practice across the different disciplines

as well as the breadth of resources that these disciplines draw upon in determining slope stability risks for land use planning.

The project team included local and central government representation, and spanned:

- Planners
- Engineers
- Researchers
- Other specialist advisors

Areas of particular interest were identified based on the geographic density of EQC claims within each case study area. Areas with a high claim density were selected for analysis (see Figure 2 for an example of claim density. In this study the red and orange areas were selected). From the identified areas a selection of consent files were reviewed and assessed against expected slope stability considerations previously selected.

The historic data from the two councils enabled a review of the type and level of information used in making decisions. These data included

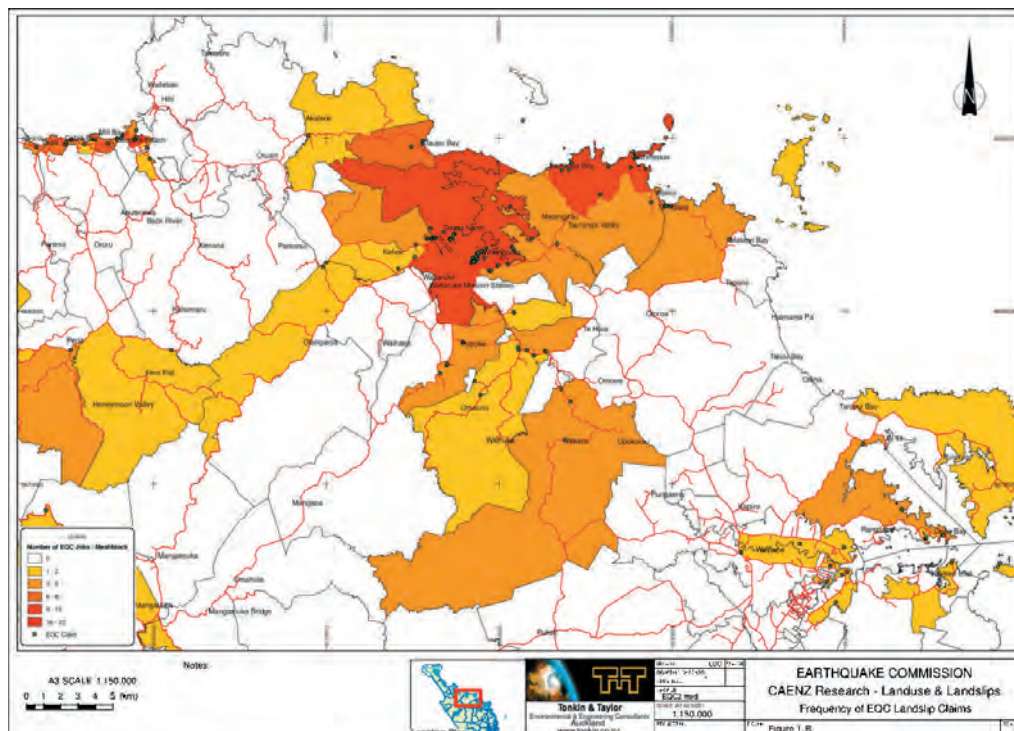


Figure 2: Geographic density of EQC claims were used to define case study areas for analysis (Red represents areas of greatest claim density)

CDEM Group plans, district plans, maps, relevant EQC landslip claims (note; numbers and location, not the claims themselves due to private information), resource consents, and geotechnical consultancy reports.

The project captured the preferences of practitioners; documenting the use of references and resources as well as the relationships between professions. Additionally, it also identified whether on not slope stability was specifically addressed within the council planning documents.

The Landslide Guidelines and the Integrated Risk Management Framework were used to inform the review of the historic data.

The study also assessed the importance of the following attributes in affecting the quality of decisions for the use of landslip prone land:

- Perception of acceptable risk
- The influence of liability exposure
- Access to and use of existing technical information
- Council capacity and capability
- Internal council processes in support of land use
- Awareness of and compliance with legislation and council policies.

Questionnaires, along with supporting material, were provided to land use planners, building certifiers, geotechnical specialists, civil defence officers and others identified within the pilot study areas in advance of two workshops that were held to address the various study objectives.

Supporting material included the Project Overview and the Landslide Guidelines. Participants were asked to complete the questionnaires in advance of the workshop. A 78% return rate was obtained for the questionnaire, providing quantifiable data for analysis of resource and practice familiarity, usage and barriers to use. In conjunction with the two workshops, questionnaire surveys provided insight into the knowledge of resources, actual practice and interactions that take place between professions.

Workshop participants were asked to provide feedback on how land use in the presence of landslip risks could improve, what they believe could change in the near future and what they saw as barriers to implementing their recommendations.

The surveys and workshops involved a range of professionals that work within each of the respective case study areas. Data obtained was analysed based on both location and professional discipline in order to seek correlations. This was then used to ascertain the profile of resource use and relative contribution of different influences in arriving at a land use decision.

2.2 Case Studies

The two councils that agreed to be case studies were the Far North District Council and Hutt City Council. Both have areas that are subject to substantial slope failure and both have implemented different techniques to try and address their slope stability risk.

Far North District is the northern most district of New Zealand and is frequently subject to weather events resulting in both saturated soils and considerable storm water run off, which contribute to landslips. As a result it has experienced a large proportion of New Zealand's landslip events. Far North District Council participated in this project as an opportunity to enhance its ability to address slope stability risk through improved land use planning and consenting approaches.

Hutt City is characterised by the Hutt River and the Wellington Fault. It has coastal cliffs and steep hillsides. Both earthquakes and weather events contribute to Hutt City's slope stability risk. Several high profile slips have occurred in recent years and Hutt City Council has been very active in educating residents on ways to minimise their risk exposure.

The respective councils have different slope stability risk profiles. Their underlying geology is different, as are their weather patterns and population profiles. Together they represent the diversity of those areas in New Zealand that are subject to slope stability vulnerabilities.

2.3 Integrating the Outcomes

In consultation with the two councils, the study team compiled the survey findings and the analysis of historical data, thereby identifying key factors including; the preferences of practitioners, the use of references and resources, as well as the relationships between professions.

The surveys were analysed for discipline and location based variations. The factors identified as influencing current practice within the case study areas were then compared against the

historical data, to assess the degree to which such factors were taken into account.

Application of Risk Management Standard, AS/NZS 4360:2004 (Standards Australia & Standards New Zealand, 2004) in the land use planning process and evidence of the implementation of innovative initiatives and their impact was also considered as part of the above survey analysis.

The approach taken proved to be a useful way to identify mechanisms that encourage the uptake of good practice by individuals and organisations engaged in landslip risk management.

3. RESEARCH FINDINGS

3.1 Overview of the case studies

Both councils' policies, plans and records, and those of the associated CDEM Groups, demonstrate opportunities for greater consideration of landslide risk.

The documents reviewed included samples of consent files, and policy documents (district plans and CDEM Group plans). Supporting tools such as district maps and consenting checklists were also considered.

The review of consenting files proved more difficult than expected. Documentation, particularly relating to older properties, were either absent, or difficult to assess due to the substantial changes in council practices and legislation that have taken place since the time at which the consent was issued.

Additionally, a large number of Far North District Council files were unable to be assessed, because emergency works had been carried out without requiring consents.

The policy documents and consent records from the two case study councils contrasted markedly. However, for both councils, review of available consent files did not show any significant evidence of geotechnical assessments routinely being undertaken.

Hutt City Council

The City of Lower Hutt District Plan (City of Lower Hutt, 2008, 2003a, 2003b) is fully operative; the substantive part of the Plan became operative from 24 June 2003, with remaining parts operative on 18 March 2004. The implication of this is that only five years of consents have been issued under the operative plan.

The review of the Hutt City district plan provisions addressing land stability for urban residential development found good use of relevant information from the Landslide Guidelines. General comments on the policies adopted were also included.

Overall the Hutt City district plan address land stability well, with specific issue, objective, policy and standards statements. Suggestions were made on some minor amendments in the future, in order to make them more robust.

The Hill Residential Activity Area (Chapter 4D of the City of Lower Hutt District Plan) comprises most of the urban areas in the eastern and western hills of the Hutt Valley, including those between Point Howard and Eastbourne. Applying the Landslide Guidelines suggests that policy related to this area could be more prescriptive regarding land stability issues.

Within the Wellington CDEM Group Plan (Wellington Region Emergency Management Group, 2005), landslides are ranked 8th (medium risk) out of 24 hazards in the Wellington region.

Fifty-eight consent files from Hutt City Council were considered. Of these, twenty-one were suitable for assessment. Many of the files contained building consent applications only. Two types of consents were supplied – those where an event had not occurred at the time of application; others post-event, where remedial works were required because of slips.

Four characteristics were apparent in the review of these files:

- An internal policy change within the consent processing team at the Council resulted in significant changes to how consent decisions were formatted. The change resulted in the officers reporting becoming considerably more comprehensive than prior to that change. Use of standard condition wording also became apparent. This change in policy resulted in a more rigorous written planning assessment. This presents substantial benefit by enabling easier monitoring of policies in the future.
- Many consent conditions referred to a suitably qualified engineer; sound engineering practices; and poor ground conditions. These three terms require qualification in order to ensure assessments are of an appropriate standard.

- Consent planners at Hutt City Council have a checklist/sheet to use for applications. This sheet specifically includes, amongst other issues, requirement for assessing natural hazards, with a peer review required.
- A few consents showed evidence of poor application. Examples of these indicated inadequate mitigation measures, short-term remediation, decisions based on inadequate information and repeated failures occurring.

Far North District Council

The Proposed District Plan for the Far North District Council was publicly notified in April 2000, with decisions on submissions released on 10 July 2003. Council then released the “Revised Proposed District Plan” which incorporated amendments made as a result of those decisions. On 27 September 2007, the Far North District Council resolved to declare the Far North District Plan operative in part pursuant to clause 17(2) of the First Schedule of the RMA from 12 October 2007 (Far North District Council, 2008). The “Partly Operative” version of the Far North District Plan, incorporates all RMA clause 16 amendments approved by Council and all amendments made to the Plan as a result of variations and Environment Court consent orders and directions (up to 27 September 2007). The implication of this is there are less than two years of consents that have been issued under the partly operative plan.

Within the Northland CDEM Group Plan (Northland Region Emergency Management Group, 2004), it is acknowledged that Northland has complex geology with a wide range of soft rocks. These soft rocks are susceptible to deep-seated movement on even very gentle slopes. They can be a threat to life and property, with one fatality in Dargaville in 1998 and significant damage to property occurring on an annual basis.

However, while the CDEM Group Plan acknowledges there is a risk to people and property from land instability, this hazard is ranked 19th out of the 23 hazards listed for the Northland region. With a SMG (seriousness, manageability and growth) score of 3.0, land

stability is the lowest rated hazard within the ‘moderate priority’ in the CDEM Group Plan.

One structure plan has been completed within the Far North District. It is for the Kerikeri Waipapa area (Beca Group & Kent Consulting, 2007). The plan includes flooding as a constraint, and subsequently as a ‘no go’ area. Climate change is the only other hazard addressed within the plan.

We comment that there is opportunity for any future structure plans to include land stability as a constraint. This could be achieved by including slope stability/susceptibility as a constraint with additional assessment criteria.

Of the twenty-two Far North District Council consent files considered, only two met the assessment requirements of the study. Consequently the sample size was insufficient for analysis. Upon investigation it became apparent that a contributing factor to the files not meeting the assessment criteria was because substantial remedial works following the March 2007, July 2007 and February 2008 events had taken place under Section 124 of the Building Act as emergency work, which does require retrospective consenting. Consequently these properties did not require retrospective resource or building consents. This hampered further efforts to re-sample Far North District files.

3.2 Survey Results

Survey participants comprised a variety of disciplines, including planning, building certification, regional and district councils, EQC, CDEM, and geotechnical consultancies. Questions related to their perceptions and experience of landslip risk and land use as well as their knowledge of and use of resources.

Questions were based on the following subject categories:

- Use of and familiarity of resources in determining risk
- Perceptions of landslip occurrence
- Perceptions of policy (local, regional and national);
- Risk monitoring;

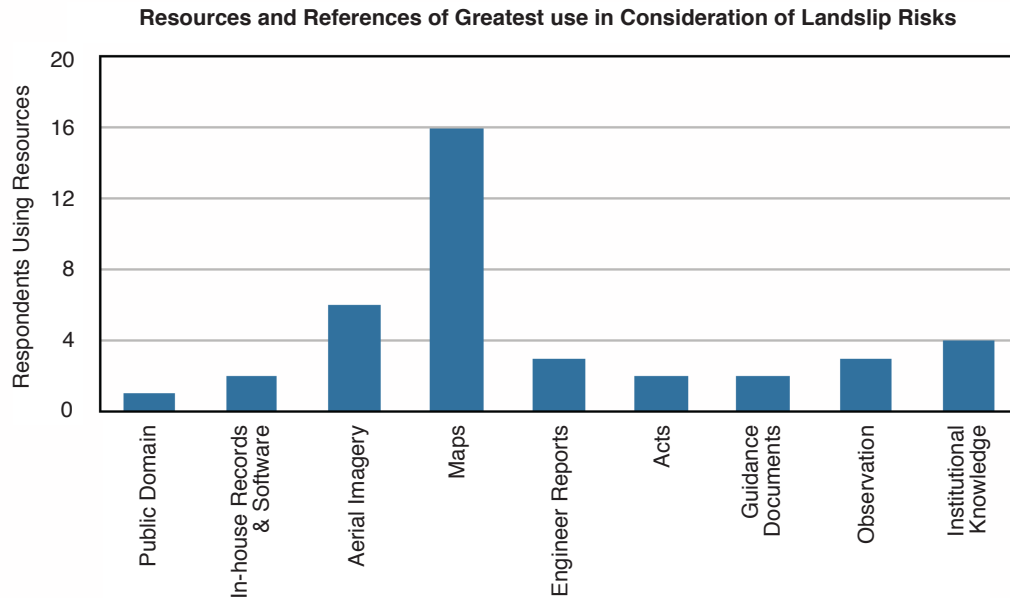


Figure 3: Use of resources in support of decision making by professionals engaged in land use within the Far North District and Hutt City Council areas

Familiarity with resources

Collectively, responses regarding the use and familiarity with resources from all respondents suggested that there is considerable subjective input in the consideration of landslip risk.

A variety of maps, aerial imagery and observation comprised the most frequently named resources used by participants (Figure 3). In contrast documents such as Acts, regulations and guidelines featured much lower than might have been anticipated.

Of the resources that participants did have access to, FNDC participants showed a strong preference towards the use of aerial photography and satellite imagery and to a lesser extent, local inventories and hazard registers. Hutt City participants also showed a bias towards aerial photography and satellite imagery but had similar familiarity with inventories and maps.

Planners (consent & policy) and engineers (civil, geotechnical & engineering geologists) showed a greater familiarity with aerial photography and satellite imagery over other resources.

The majority of participants had not seen the Landslide Guidelines prior to completing the

workshop questionnaire (80%), and of those that had, most had not used it.

Of those that had seen the Landslide Guidelines but did not use them, reasons varied; with the majority having not had them long enough to have used them or had not processed a consent since reading that they considered relevant. Other feedback included;

- “the advice is too general and focussed too far towards “avoid” landslip rather than looking for appropriate solutions to manage (by engineering) the risk”,
- “we prefer to rely on site specific advice of qualified persons”.

It was notable that some resources were known by participants, but they did not have access to all of them (Figure 4); primarily databases and maps.

Perceptions of landslip occurrence

Consistently across both case study areas, participants indicated a view that these regions experienced more frequent and more severe landslips than other parts of the country. The importance of land use on susceptibility to landslips was considered a significant contributing factor.

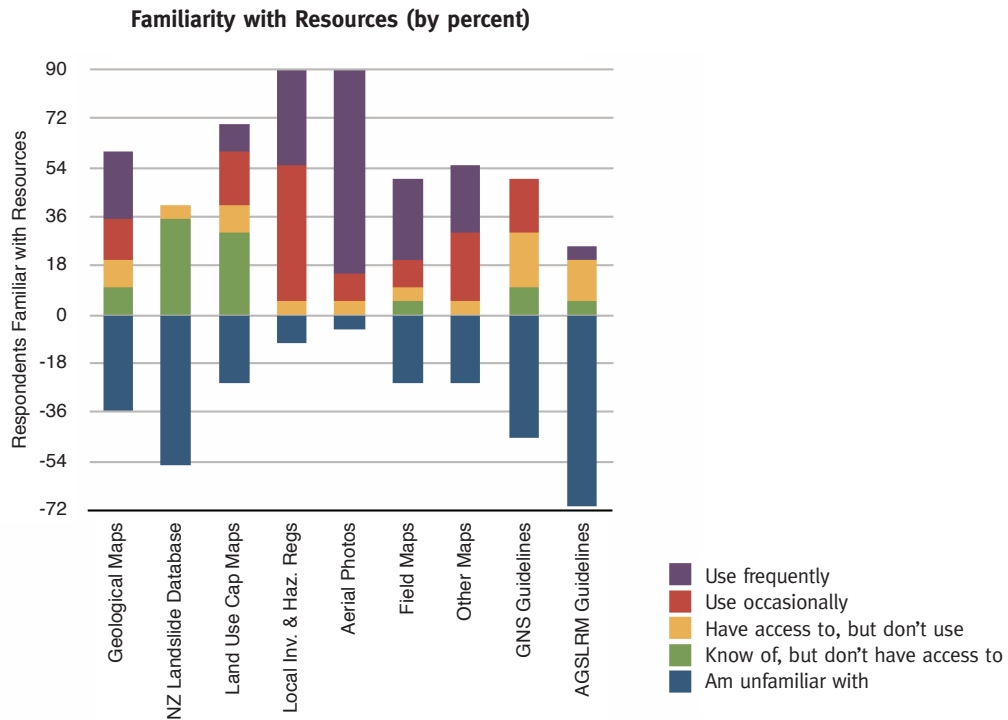


Figure 4: Familiarity with available resources that support slope stability consideration of land use indicates a preference for visual resources

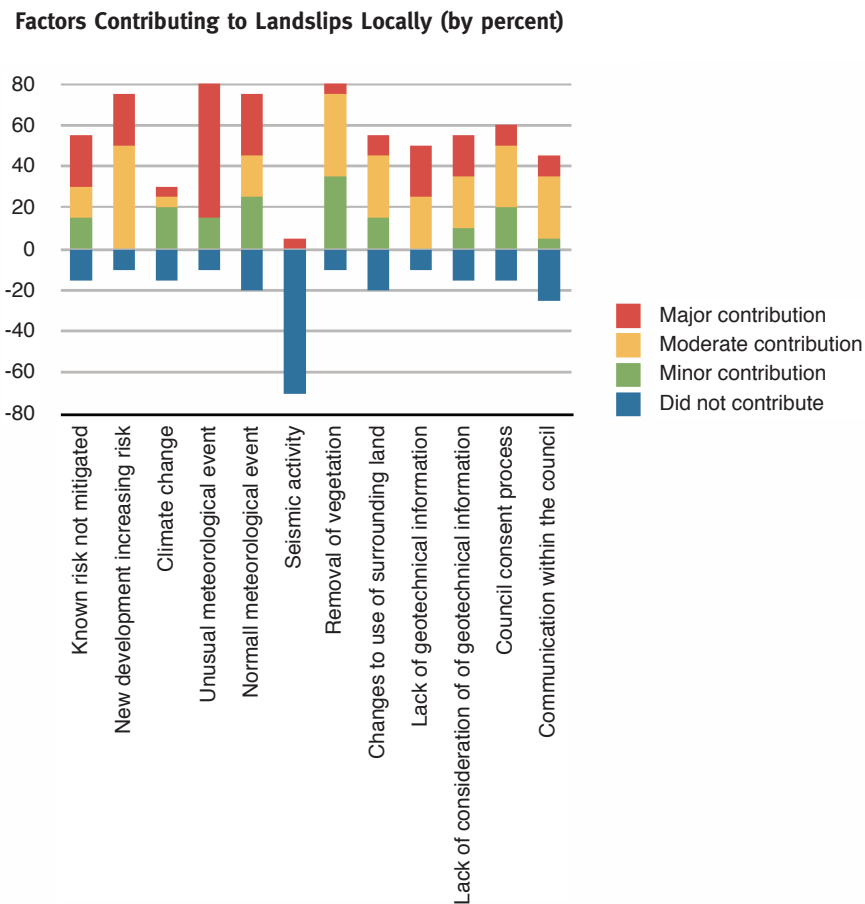


Figure 5: Unusual meteorological events were viewed by participants as having the greatest contribution to landslip occurrence with new development, removal of vegetation and normal meteorological events also providing significant contribution

Future development of land was thus considered to warrant greater attention than existing land use or current land development.

Both councils indicated that urban and coastal areas experienced a greater frequency of landslips than other areas, (with coastal areas considered to be the most frequently affected). Unusual meteorological events were considered the highest contributor to landslips overall and across all professions (Figure 5).

However, Hutt City based participants also indicated that new development increasing landslip risk is a significant contributing factor.

Perceptions of policy

Participant opinions of Local, Regional and National policy regarding landslip risk were consistent although not all participants chose to comment on the policy section of the questionnaire. Of those that did, there was notable dissatisfaction with the adequacy of policy consideration of landslip risk. Planners overwhelmingly described policy as less than adequate at the local level.

Enhanced hazard information sharing was cited as providing the greatest opportunity to improve policy development; primarily through improved presentation and quantity of information available (as geographical layers) for communicating with decision makers.

Professional standards criteria was also raised as a means for effecting improved implementation of policy and practice. Participants considered that the adoption of such standards would enhance policy development at local and regional level.

Risk Monitoring

Of the planners that participated in the questionnaire the majority rely on the use of a checklist as their preferred risk-monitoring tool.

The most frequently suggested opportunity for enhancing the monitoring of landslip risk was greater information sharing and access to information held by developers, consultants (planning and geotechnical), EQC and councils.

Land use practice

Participants were asked to provide feedback on how land use management in the presence of landslip risk could improve, what they

believe could change in the near future and what they see as barriers to implementing their recommendations. The questions posed and the three most common responses, in order from most frequent to least frequent, are as follows;

Q1: Greatest opportunity for improving the effectiveness of landslip management in New Zealand?

- Investing in local authority capacity, education and skills;
- Educate the public sector on the costs of landslip risk realisation and the value of specialist reports;
- Increased information sharing across professions;

Q2: What participants would change regarding landslips and land use practice?

- Prevent development/ provide more prescriptive controls in vulnerable areas;
- Improved stormwater management;
- Consolidation of information into a central repository;

Q3: Current opportunities for improving landslips land use practice?

- Education;
- Plan change;
- Councils need to require greater rigour before signing off building consents;

Q4: Current barriers to improving landslips land use practice?

- Cost/Economics;
- Reluctance to share information;
- Concern over liability;

Communication

Across all participants there was a strong opinion that local authorities (and others) do not interact effectively regarding landslip considerations. The majority reported that communication between disciplines occurred irregularly. It would be worth exploring the value of communication and preferred means of communication to a greater extent in any subsequent work.

As previously described, workshops were conducted in the two case study areas. During

the workshops participants mapped out land use processes and attributed values to the different resources and influences that impact slope stability based decision making by the various professions engaged in each step of the process. Participants were grouped according to their professional discipline in order to complete this activity.

Following the workshop the results were compiled and a series of three flow charts (Figures 6, 7 and 8 - see following pages) were developed in order to illustrate the land use process. Figure 6 illustrates the process that takes place from land being first seen by the purchaser, until resource consent is issued. Figure 7 illustrates the building consent process and Figure 8 shows the process that takes place following a landslide.

In each figure, charted steps connected by arrows describe the process flow. Different professions lead the decision-making process for different steps. The steps are referenced to those professions that have the most significant role in determining the outcome of that step (e.g. developer, engineer, etc.).

In determining the outcome of each step a range of resources are used and various influences impact on the decisions that are made. The actual relative strengths of the influences that come into effect and the degree to which resources are drawn upon are listed at the base of the chart and indicated by colour. The relative values range from 1-5 with 1 being the most significant and 5 being the least significant.

It was generally acknowledged within the workshops that the ranking attributed to resources and influences in practice is not necessarily as it should be in theory. For example 'common sense' and 'anticipate end user' were ranked low in terms of actual influence but were acknowledged that they should be higher. The attribution of values based on actual practice means that in the future a comparison can be conducted to determine how usage of resources and influences change.

It should be acknowledged that although the values given are representative of workshop participants and the project team's experience, there may be localised variations in different parts of the country.

In addition to the structured investigations that took place within the case study areas the study team was able to contribute further observations based on previous experience and knowledge. This provided both insight and context to the research findings. It also raised awareness of resources that different disciplines rely on in undertaking their role in advising or implementing the planning process.

One initiative that came out of these interactions was to consider the relevance and opportunity to adapt the Practice Note Guidelines for Landslide Risk Management (AGS, 2007b) to New Zealand. This was unable to be completed as a part of this project but is being investigated.

Discussion of suggestions arising from the workshops and practice by different councils also led to an appreciation of the role that Producer Statements and registers of Producer Statement authors can play in reducing the workload associated with consent considerations.

Producer Statements are issued by qualified professionals, such as Chartered Professional Engineers, and provide Building Consent Authorities with reasonable grounds to issue building consents, without having to duplicate construction checking. Some councils maintain registers of individuals from whom they accept Producer Statements.

The methodology of this study enabled multidisciplinary perceptions of current practice to be captured. This approach has the potential to measure the effectiveness of progressive actions that are taken to improve land use management. Repeating the workshops and surveys over time could provide benchmarking to measure any change in influences and resource use as efforts are made to advance the consideration of slope stability in land use planning.

For Hutt City and Far North District Councils, undertaking the workshops and surveys, in addition to reviewing past consenting and planning decisions, provided a snapshot of current practice. These Councils can revisit the surveys in the future, as a means of gauging the progress they have made towards addressing the land use management needs that they have identified.

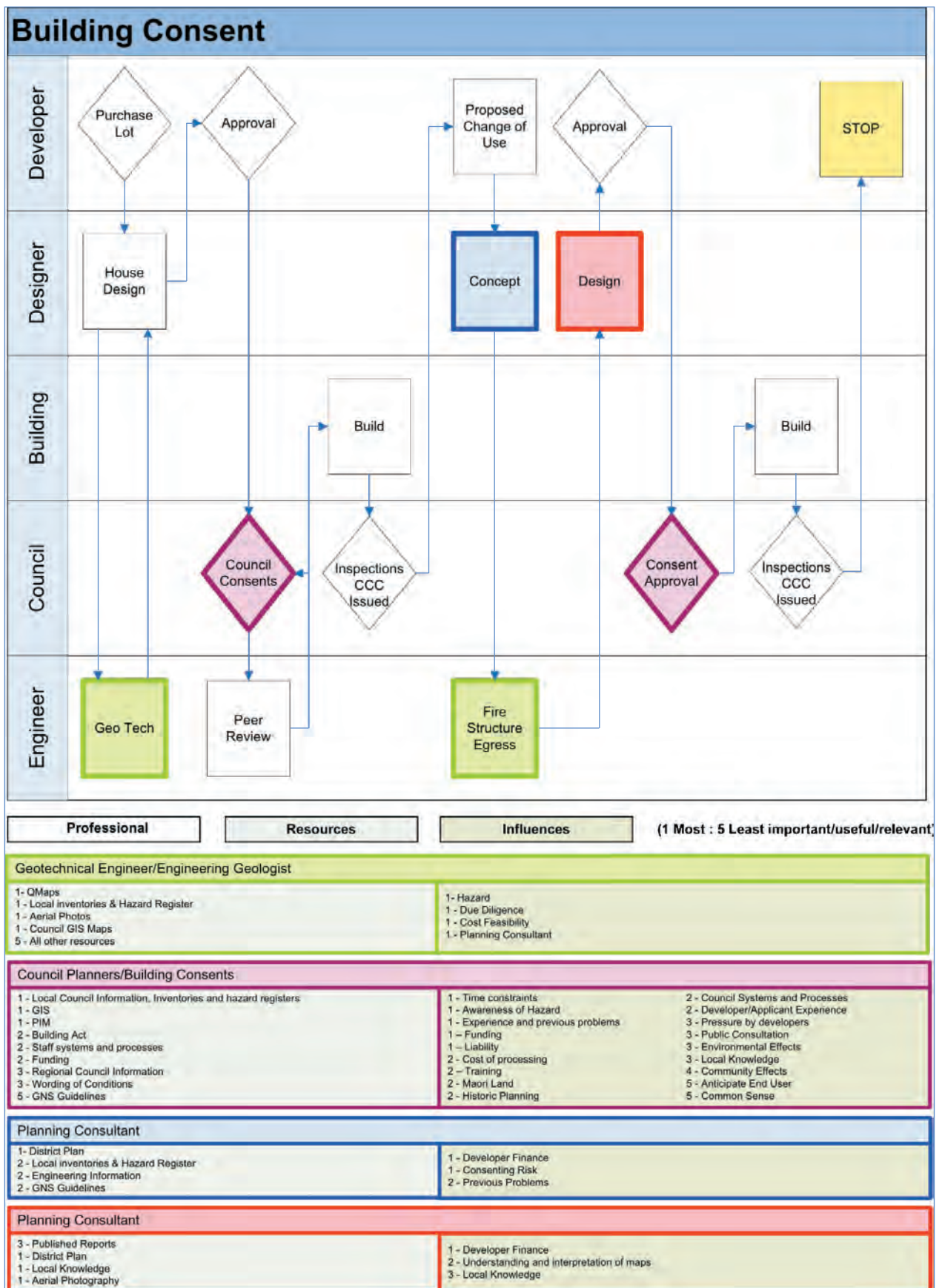


Figure 7: Process Flow Diagram for Building Consenting

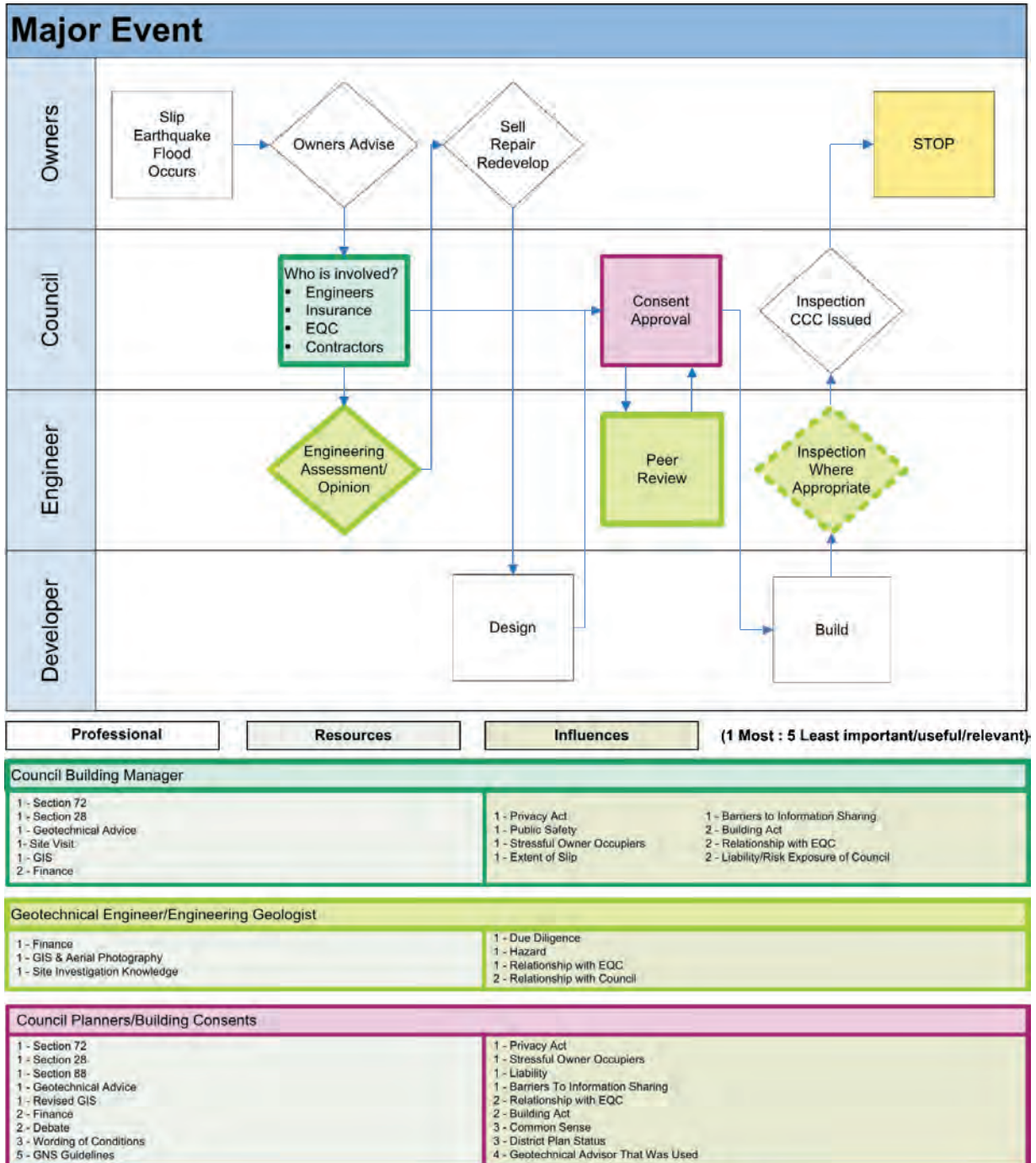


Figure 8: Process Flow Diagram for Landuse Approval after major event

4. LESSONS FROM THE STUDY

Both the Landslide Guidelines and the Integrated Risk Management Framework advocate collaborative approaches to addressing slope stability in land use planning. This study identified ways that facilitate greater collaboration. In particular the study highlighted three areas where effort could be focused in order to produce greater collaboration:

- Sharing of information,
- Raising the profile of slope stability risk, and
- Extending accountability.

4.1 Sharing of information

Two main barriers to the use of existing knowledge were identified. The first was that for information to be readily adopted it needs to be presented in an appropriate format. For example distribution of large documents to councils did not receive as great attention as the provision of checklists or visual references.

The second barrier was a limited awareness of the range and volume of information that is held on slope stability by different organisations. This became apparent through workshop interactions where individuals spoke of the resources that they drew upon in considering slope stability. In several instances other participants were unaware of the existence of these information sources or means by which to access them.

Presenting information

Efforts are required to encourage researchers to present information and develop tools with a strong spatial component. Information provided in this form can be integrated more readily into land use practice than that provided by other means.

The survey and workshop findings indicated that those engaged in land use related disciplines are most comfortable employing visual and spatial concepts. This needs to be reflected in the presentation of new tools and information intended to enhance consideration of slope stability. The use of visual tools assists in both the implementation of land

use practice and in expressing data (often through the use of GIS) when communicating the context of hazard considerations, such as landslips, between stakeholders including officials and owners who may not have a technical background.

Data sharing

The study identified that considerable quantities of data are held and managed by individual organisations. The associated maintenance, in terms of time and resources, is substantial. Additionally, holding data internally can lead to multiple organisations maintaining duplicate data.

This can lead to under-utilisation of data and rapid dating. Awareness of either the presence of existing data sources or means by which they can be accessed may be lacking, and updating of data may not be consistent across organisations.

The diversity of experience of those that took part in the workshop proved useful as a means of raising awareness of these issues. The desirability of sharing existing tools and resources held within a particular area and elsewhere was indicated, and initial discussions on the value of consolidated data repositories were also initiated.

Specifically, the following data sources were identified which, if shared or made more readily accessible, would improve the quality of decisions and may in some cases provide opportunities to distribute the burden of data maintenance:

- Composite EQC data (see Appendix 4);
- GNS geological maps;
- District and Region wide database reports indicating where and what kind of information is held;
- Consolidated geographic information.

The value of data sharing could be further extended to encourage councils to contribute file data to centralised repositories such as mapping datasets held by GNS Science. Open-access would need to be secured to make this attractive.

Similar workshops would likely prove useful to other local authorities as a means of determining the extent and sources of information that can contribute to understanding slope stability risk in their area. This has the potential to lead to more effective use and management of available data.

4.2 Raising awareness of slope stability as an issue

Raising the public profile of landslide risk is important. Increasing the public appreciation of slope stability will do much to foster responsible land management by owners, e.g. considered removal of vegetation.

Two specific mechanisms identified through the case study work were:

- Public education on how homeowners can modify their risk exposure;
- Greater emphasis on identifying potential landslide areas on Hazard Maps and Land Information Memorandums (LIM's).

Ways to raise practice standards through learning from peers and across disciplines were also raised.

Public education on slope stability

Hutt City Council has been actively informing owners on managing their slope stability risk.

They have done this through distribution of brochures (Appendix 3) and publicising the impacts that landslips have had in their area.

Regular distribution of educational brochures assists to raise awareness of the risks and mitigating actions that can be taken by new and existing residents of vulnerable land.

Raising the profile of landslips that have occurred is also a public education tool.

Landslip history combined with geotechnical and geomorphologic mapping enables the assessment of slope stability. Not all councils record landslide risk on their hazard maps and therefore Land Information Memorandums do not necessarily reflect the landslide risk profile of a property. Shared hazard databases and mapping resources, as suggested in workshops and surveys, would provide greater consistency and promote the dissemination of slope stability data into the public domain.

Profession and sector based professional development.

From the many discussions and shared experience that occurred during the course of the study, it became obvious that many councils have developed good practices, which could be emulated by others. The examples given in the study surveys and examples from the Landslide Guidelines can help inform



Figure 9: The consequences of ill-considered land use provide an opportunity to raise awareness of slope stability risk (photo courtesy of Hutt City Council)

councils (and practice areas within councils) of successful approaches taken by their peers. This was reinforced by the excellent interaction seen between the different disciplines that participated in the workshops. Such interaction helps develop best practice

Councils are encouraged to take note of the Landslide Guidelines and the Integrated Risk Management Framework for assessing consents for both urban and other usage situations. Doing so would provide greater consistency in decisions through the adoption of a risk-based approach and the quantification of acceptable risk exposure consistent with the accepted risk management practice. (AS/NZS 4360:2004¹, Standards Australia and Standards New Zealand, 2004).

Development and adoption of an accompanying Engineering Practice Guide would complement this approach, providing greater certainty for developers and landowners. This could be undertaken by adapting the Practice Note Guidelines for Landslide Risk Management (AGS, 2007b) as a resource for New Zealand geotechnical specialists.

Further benefit could be obtained by examining the various examples of good practice cited by practitioners through the workshops. More work is yet needed to determine how well these cited practices performed in reducing landslide risks. Results could be disseminated through local government based forums.

As evidenced from the survey questionnaires, communication between disciplines is often irregular, although the respective professional societies (e.g. IPENZ, NZ Planning Institute, Royal Society) attempt to address this. Scheduled forums where the different disciplines can be briefed on latest developments and collectively discuss issues and solutions would improve both awareness of the implications of landslide risks and improve existing practice.

¹ Soon to be replaced by the International Standard Risk Management Principles and Guidelines (ISO/FDIS 31000)

4.3 Extending accountability

Greater emphasis on slope stability through more explicit consideration within council policies and consenting requirements has the potential to reduce landslide risk. Strengthening existing mechanisms should be combined with improved practice through training and more rigorous certification of work. It is believed that this would have a positive effect in transferring greater accountability to those involved in the consent process.

Existing mechanisms and opportunities to extend accountability

Councils play the main role in the process of ensuring that appropriate decisions on land use are made; yet several councils typically do not have in-house expertise for assessing landslide risk. In order to assess a developer or land owners proposal, the council often commissions peer reviews of other expert analysis, resulting in extra costs and delays to the developer.

Reliance on external consultants does not transfer liability from councils. Reports, peer reviews, engineering assessments and solutions may be inadequate to allow councils to determine their risk exposure. Different councils have taken different approaches to address this.

One approach based on workshop and project team discussions, is to make greater use of Producer Statements with backup insurance requirements - and holding consultants to account when there is a failure.

It was suggested that this process could be useful for both the council and the developer (if developers' advisers were able to self-certify their work). This would presumably require consultants to be registered by a suitable body as having the experience to undertake the type of work and then to certify their work through a Producer Statement.

In instances where land management practices have led to landslips, these have often been the result of the policies at the time. To remedy such instances two opportunities can be considered; a notified consent and a specialist assessment.

A notified consent presents numerous aspects of the development to scrutiny, but in many cases all that is required is an assessment of the landslip hazard. It is therefore more useful to stipulate where specialist assessments are required, and then require more specific assessment criteria for these locations.

Understanding the accountability tools available through these mechanisms and

others, such as provisions of the Building Act, provides a basis for mandating minimum expectations from a range of disciplines.

Consistently establishing these expectations places councils in a better position to hold to account those responsible for any specific advice or technical assessments if or when there is a failure, and to collectively influence the rigour on those disciplines involved.

5. CONCLUSIONS

In summary, this study has illustrated that the greatest opportunities for improving practice in land use planning is through ensuring a collaborative and informed approach to balancing development pressure and slope stability risk exposure.

The recommendations arising from the study focus on three broad concepts;

- information sharing,
- improved methods of communication about slope stability risk,
- extended accountability.

These are set out below, with each presenting a number of discrete actions that can be taken. Some require little cost and have potential to achieve rapid results, others require long-term commitment and centralised leadership.

Few of the recommendations can be implemented by a single organisation or profession. Virtually all require improved communication and greater collaboration between disciplines and across organisations.

What this study has shown is that one of the simplest, and likely most effective actions would be regular multidisciplinary discussions of the land use issues encountered in the local area.

Such discussions would enable all professions to maintain a current knowledge of concerns and awareness of good practice, as well as promote new knowledge and particular concerns that might arise.

While many of the recommendations require local action, national agencies could facilitate more effective management of slope stability risk.

In conclusion, therefore, we commend the following recommendations for further consideration and possible uptake.

5.1 Short term/immediate implementation opportunities

- Regular multi-disciplinary discussions of landslip issues and solutions established locally.
- Formation of district or regional databases or database directories for hazard information, accessible to all, held and managed by local councils.
- A greater focus by research on presenting information with a strong spatial component.
- Greater use of Producer Statements with accountability requirements could be encouraged.
- Regular targeted circulation of public education material to households in vulnerable areas, describing how to reduce landslip risk through appropriate property maintenance.
- Greater consideration and promotion of the Landslide Guidelines and the Integrated Risk Management Framework by councils to provide greater consistency in assessing consents and to demonstrate a reasonable level of duty of care.

5.2 Longer term implementation opportunities

- A national benchmarking process to promote improved practices.
- Improvement of future generations of council plans to better reflect and recognize slope stability risks.
- A Landslip Engineering Practice Guide to be developed for New Zealand.
- Known landslip risk areas identified on public hazard maps and also made available through LIMs.
- Development of a comprehensive and freely available national set of large-scale detailed map sheets consolidating existing landslip information for urban areas.
- The development of national standards to better address landslip risk.

This study reports on research that identifies opportunities for improved landslip risk management.

The framework adopted advocates integrated management approaches and more specific assessment criteria. However, going forward

will require further collaboration and a collective undertaking to address the various issues raised during the course of this study.

The study, itself, has demonstrated a willingness of all those involved to progress such an initiative.

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APPENDIX 1: Integrated Risk Management Framework

New Zealand uses an integrated system of organisations and policies to address natural hazard risks. The Integrated Risk Management Framework below is extracted from Managing Landslip Risk: Improving Practice (CAENZ, 2007). If used in conjunction with the Australian/New Zealand Standard for Risk Management (AS/NZS 4360:2004¹, Standards Australia and Standards New Zealand, 2004) it

offers a systematic approach to slope stability risk management. The framework presents a logical sequence of interrelated steps beginning with understanding the risk through to ongoing assessment. It recognises that natural hazard risks are not static. As surrounding changes in land use occur the risk must be continually reviewed in order to be effectively managed.

1. ANALYSIS - This step is required to inform Participants

Activity	Desired Outcome	Recommended Actions
Strategic Awareness	There is a clear understanding of the causes of risks, their extent, and future projections, within which to focus participation.	Review occurrences for number, location, cause, costs, etc. Assess causes and trends (to determine importance of task). Assess international practice for possible contributions.
Advocacy Analysis	Participants are aware of the critical points to participate in the development and application of expertise and knowledge, and in the design and management of the regulatory regime utilised by government.	Develop "map" of current roles and responsibilities of all those involved, as well as understanding their plans and politics, and how to best interact with each.
Stakeholder Analysis	Participants understand what stakeholders presently contribute to risk management and what role they might be willing to accept in managing the framework.	Consult with stakeholders to determine what current activities exist, their effectiveness, concerns and future plans, and how each may partner.
Risk Assessment	Participants appreciate the risks associated with participating to ensure the best possible decision-making relating to the built environment of NZ.	Prepare a risk map of the necessary participation opportunities in the decision-making for the built environment. This means assessing the possible success of each intervention, any barriers, and options for addressing these. Then devise a plan to address using the activities below (and others as required)

These activities will define the others below.

¹ Soon to be replaced by the International Standard Risk Management Principles and Guidelines (ISO/FDIS 31000)

2. RELATIONSHIP MANAGEMENT - This step is required to build relationships participants need to play an effective role in managing risk.

Communications (outward focussed and related to the development of the Framework)	Professionals, their associations and local authorities are aware of the implications of poor risk management and the need for this Framework. Participants' role, process and desired outcomes are known with respect to this exercise.	Ensure messages are identified, clarified, and delivered consistently in publications, websites, conferences, etc. Adopt a clear communications strategy for its engagement with stakeholders.
Networking (long term co-ordination on the Framework)	This Framework is managed collectively by partners.	Link to other professional groups important to the success of this initiative (engineering, geotechnical, planning, etc.). Link to key central and local government management and technical processes.

3. ADVOCACY STRATEGIES - This step is important for getting the work done.

Legislative Framework	Legislation and national policies in place create the opportunity for good governance and best practice decision making at all levels. Liabilities arising from decisions on risk are known.	Assess existing legislation for completeness. Identify and assess central government roles and responsibilities to identify strengths and gaps, and to develop any required solutions. Assess how liabilities are managed within and across governments.
Data and Information	Relevant data and information is publicly available. Other publicly funded data and information important to risk management is made readily available. Suitable technologies are available to expedite decisions.	Data and information is made readily available as required. Identify these sources, the value of their contributions and all access issues. Identify technologies, software and data protocols that are commonly, or should be commonly available.
Research	Research requirements necessary to improve understanding are known and acted upon.	In consultation with practitioners, tertiary education institutions, CRI's and funding agencies to develop an agenda for research, set priorities and assist in securing financing. Identify areas where funding can assist in the uptake of science in decision-making. Identify and support pilot studies on the application of new approaches.

3. ADVOCACY STRATEGIES cont.

Methodologies, Benchmarking, Standards, and Guidelines	External professional fraternity has the appropriate “tools” to address risk management issues Programme and project managers are aware of risk and how best to manage it.	Review existing “tools” for adequacy and where necessary set out strategy to fill critical gaps where these are relevant (what gaps, who can partner, what priority, etc) Establish work plan, contributors, finances, partners, etc to update/modify/create related methodologies, benchmarked processes and information, standards and guidelines. Manage development of work plan Promote relevant “tools” through workshops, conferences, etc. Maintain vigil on adequacy and evolving needs Best practise is identified and promoted. Monitoring of revised standards and guidelines Develop risk-based management methodology to assist managers of projects/programmes to improve decision making on risk.
Regulatory Process Improvement	Local Government planning, consents, compliance and policy processes allow for the successful applications of the risk management advice.	Identify critical areas that have to be prepared for any revised approach (legislation, planning and policy, etc, human behaviour, awareness, etc). Develop change needs for each critical area, and how this might be achieved. Develop a plan to influence these critical areas (this might include engaging central government to change legislation or department policies, some might be done through awareness initiatives).
Education	Tertiary Institutions have appropriate awareness and training in their course work.	Identify Tertiary Institutions’ current engagement. Develop engagement strategy messages, priorities, contacts, etc Engage Tertiary Institutions’ to develop content with assistance as required Promote good uptake with appropriate recognition (student awards, TI awards)
Professional Development	Continuing professional development initiatives endorse risk mitigation training etc where applicable.	Workshops Conference support Fellowships
Accreditation	Professional standards are maintained.	Identify professional accreditation needs.

4. EVALUATION AND REPORTING - Needed to complete the framework in giving management continual assessments of the progress of the initiative.

Evaluation	Participants' management is aware that its investment in loss reduction is effectively contributing to the improvement of decision on risk.	Develop reporting process for Framework with outcomes, outputs, timelines, etc. Identify appropriate methodology for "measuring the impact" of science investments.
Reporting	Partners to the Framework are aware of progress. Participants are aware that their investment in the research programme is generating the desired outcomes.	Reporting schedule and process to be developed. Staff regularly report on progress made. This should incorporate input from partners.

APPENDIX 2: Glossary of Terms and Acronyms

AGS	Australian Geomechanics Society
BOINZ	Building Officials Institute of New Zealand
CAENZ	The Centre for Advanced Engineering New Zealand
CDEM	Civil Defence Emergency Management
DBH	Department of Building and Housing
EQC	The Earthquake Commission
Failure	In this instance failure refers to the realization of a landslip or landslide
FNDC	Far North District Council
GIS	Geographic Information Systems
GNS Science	The Institute of Geological and Nuclear Sciences, a Crown research institute (CRI).
Hazard	A potentially damaging event occurring within a given area within a given time.
HCC	Hutt City Council
ISSMGE	The International Society of Soil Mechanics and Geotechnical Engineering
Landslide	The movement of a mass of rock, debris, or earth (soil) down a slope (ISSMGE, 2004)
Landslip	The Earthquake Commission Act 1993 defines natural landslip as “the movement (whether by way of falling, sliding or flowing, or by a combination thereof) of ground-forming materials composed of natural rock, soil, artificial fill, or a combination of such materials, which before movement, formed an integral part of the ground; but does not include the movement of the ground due to below-ground subsidence, soil expansion, soil shrinkage, soil compaction, or erosion
LGNZ	Local Government New Zealand
LIM	Land Information Memorandum
LINZ	Land Information New Zealand
LTCCP	Long Term Council Community Plan
MfE	Ministry for the Environment
NRC	Northland Regional Council
NZGS	New Zealand Geological Society
RA	Regional Authority
Risk	The chance of something happening that will be an impact. A risk is often specified in terms of an event or circumstance and the consequences that may flow from it (Standards Australia and Standards new Zealand, 2004)
RMA	The Resource Management Act 1991

Slippage	Term used in the Building Act 2004. This has the same meaning as landslip under the Earthquake Commission Act, but in the context of the land on the site moving offsite.
Slope failure	The realisation of a landslip or landslide. Slope failures are the result of gravitational forces acting on a mass which can creep slowly, fall freely, slide along some failure surface, or flow as a slurry. (Hunt, 2007)
Slope stability	The resistance of an inclined surface to failure by sliding or collapsing (Kliche, 1999)
Structure Plan	Is a framework to guide the development or redevelopment of a particular area by defining the future development and land use patterns, areas of open space, the layout and nature of infrastructure (including transportation links), and other key features for managing the effects of development. (Quality Planning Website)
Susceptibility	Being prone to. In terms of landslides this refers to a quantitative or qualitative assessment of the classification, volume (or area) and spatial distribution of landslides, which exist or potentially may occur in an area (ISSMGE, 2004)
TA	Territorial Authority
Vulnerability	Exposure to damage, the potential degree of loss.
GWRC	Greater Wellington Regional Council

APPENDIX 3: Hutt City Council Brochure



Managing the risk of landslides
A guide for people on hillside properties



When do retaining walls require a building consent?

A building consent is required for retaining walls that:

- Are more than 1.5 metres in height; or
- Support any surcharge.

A surcharge is any load, in addition to the level ground, that will push against the wall. Surcharge loadings include sloping backfill above the wall, trees, water, vehicle decks, driveways and fences. Walls that support a surcharge must be designed by a chartered professional engineer, and supporting calculations included in the building consent application.

Regardless of whether or not the wall needs a building consent it must comply with the Building Code. Council Building Consent Officers can answer any questions you may have about building consents and the Building Code. Further information can be found on the Council website: www.huttcityinfo/building

When do retaining walls require a resource consent?

The resource consent requirements for retaining walls vary depending on which activity area (zone) your property is in under the District Plan.

Constructing a retaining wall usually involves earthworks – moving earth or fill. In Hill Residential and Landscape Protection Activity Areas resource consent is needed for all earthworks. In other residential activity areas resource consent is required if the natural ground level is to be altered by more than 1.2m vertically and/or more than 50m² of earth or fill is involved. You may be required to provide an engineer's report with the application. There are also rules for earthworks in non-residential activity areas. Contact a Council resource consent planner for further information.

The location and/or height of the wall may also mean that it needs resource consent. Council resource consent planners can advise you on the requirements of your particular proposal. Copies of the District Plan are held in all Hutt City libraries. Further information can be found on the Council website: www.huttcityinfo/districtplan

◀ Please note the retaining wall illustrated at left would require a building consent and may require a resource consent.

Planning on building or landscaping?

Building and landscaping work such as laying driveways and paving, building decks, fences and retaining walls, removing vegetation and doing earthworks, all have the potential to increase the risk of landslides.

If you are planning on doing any building or landscaping, you should consider the following things before you start:

- Steepness of your property, soil type, nature of surface material, vegetation cover, water flows and drainage. Seek professional advice if necessary.
- Location of stormwater systems and utilities.
- Potential effects on neighbouring properties, including those properties above and/or below yours and those on either side.
- Provisions of the City of Lower Hutt District Plan and resource consent requirements.
- Provisions of the Building Act, Building Code and building consent requirements.
- The Small Earthworks Guidelines, available from Greater Wellington Regional Council.

Thinking of building a retaining wall?

Retaining walls are commonly built on sloping properties and come in a variety of sizes and materials. They promote slope stability by reinforcing a cut slope. However, careful design and maintenance is required. While possible to build them yourself, it is best to consult a chartered professional engineer. Specific design may be required depending on the soil type and level of the water table. Adequate drainage is very important. Allowing water to build up behind the wall can cause it to fail.

For further information, see BRANZ Bulletin 394 Low Retaining Walls available at www.branz.co.nz



Illustration by Daniel Mills

See your Council first!

Council Officers can:


- Give you information about your property, including what activity area it is in.
- Explain the District Plan, Building Act and Building Code, Resource and Building Consent requirements.
- Inform you of what expert information you require.
- Advise on the best plants to promote stability.
- Provide emergency preparedness information.

Contacts

If you have any questions, please contact:

Development Services Group
Hutt City Council
30 Laings Road
Private Bag 31912
Lower Hutt

Tel: (04) 570 6666
Email: contact@huttcity.govt.nz
Web: www.huttcityinfo

June 2006

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Landslide risk

The steepness of hills in the Hutt area, particularly around Stokes Valley, the Eastern Bays and the Western Hills, makes them prone to landslides. Heavy rainfall in 2004 highlighted the threat landslides pose to people and property: some houses were left uninhabitable.

Areas of highest risk

The areas of highest risk from landslides in the Wellington region are:

- Steep slopes greater than 35 degrees.
- Slopes that have been altered, such as cuttings along roads and behind houses, or where vegetation has been removed.
- Where the underlying rock is weathered or shattered, or where the surface material is soft or loose.
- Where landslides have occurred in the past.

For further information about landslides and what causes them, see Greater Wellington's Landslide Hazard Factsheet, available at www.gw.govt.nz

How to manage the risk of landslides on your property

1. **Know your property**
Research the history and geology of your property. Talk to neighbours and Council officers to find out if landslides have previously occurred in your area.
2. **Get professional advice**
Before starting any building or landscaping, or if you have any doubts about the stability of your property, seek the advice of a chartered professional geotechnical engineer. A list can be found in the Yellow Pages under "Engineers – Consulting". Obtaining professional advice early on can prevent having to take extensive remedial action later.

Be prepared

- Maintain an emergency plan and survival kit. Contact the Council for an Emergency Planning Guide or see the back page of the Yellow Pages for more information. Further information can be found on the Council website: www.huttcity.info/emo
- Regularly inspect and maintain your property. The Checklist below right can be used as a guide.
- Report the location of any landslides that you find to Council officers.

What should you do in a landslide?

1. Evacuate – take your emergency kit.
2. Warn neighbours who might be affected.
3. Contact the fire service, police or local civil defence emergency management office.
4. Do not re-enter your property until it has been inspected and deemed safe.

Protecting your property: Steps you can take

Be aware of the signs of instability and fix the problem.

Check your property regularly, especially after earthquakes, long dry spells or heavy rain. Consult a chartered professional geotechnical engineer for advice if you notice:

- Slope movement, such as small slips, rock falls, subsidence or bulges at the bottom of slopes.
- Cracks in ground, plaster, brick work, tiles, foundations, retaining walls, driveways and other hard surfaces.
- Tilting trees, walls or fences.
- Ground that has become waterlogged, or water seeping at the bottom of cut slopes.
- Building movement such as doors or windows that stick or jam, and outside fixtures such as steps that are pulling away from buildings.

Drainage: Too much water is the most common trigger of landslides. Consider drainage patterns when changing the slope of your property. Stormwater must drain to approved outlets – do not let it build up. If uncontrolled stormwater runoff damages other properties you may be legally liable for the damage.

Vegetation: Think carefully before removing shrubs and trees. Plants maintain stability as they hold the soil and soften the impact of rain falling on the ground. Cutting down a tree but leaving the stump does not maintain long-term stability. Tree roots shrink as they rot, leaving space for water to enter the soil and weaken the slope. Don't let garden waste pile up as it can add material to debris flows. In some areas, vegetation removal requires a resource consent. Check with Council resource consent planners.

Earthworks: Digging up the ground can cause slope instability – especially if the toe of a slope is removed. Consult a chartered professional geotechnical engineer before planning any earthworks on slopes. A consent may be required by the District Plan or Council bylaws. Check with Council consent officers.

Hard surfaces increase runoff. Use porous alternatives, such as gravel, where possible, or install additional drainage. Any hard surface greater than 45m² must be connected to the stormwater system and requires a building consent.

Original illustration by Daniel Mills

CHECKLIST:

	Check for	Action
Spouting, guttering, drains & culverts	Blockages & overflows	Clear all dirt, leaves and other blockages, empty filters
	Cracks & leaks	Trim back or remove vegetation blocking drains and gutters
Retaining walls	Blocks in drainage system	Repair cracks & leaks
	Water build-up behind the wall	Clear drainage system
Hard surfaces	Excess runoff	Consult a chartered professional engineer for advice
Garden & grounds	Piles of garden rubbish on slopes	Install adequate drainage/stormwater controls
	Bare slopes	Dispose of garden rubbish
	Cracks (especially above cut slopes)	Plant bare areas
		Consult a chartered professional geotechnical engineer for advice

Side 2 of 2006 Hutt City Council fold out brochure.

APPENDIX 4: Information held by the Earthquake Commission

Claims Information is Private Information

Under the Privacy Act 1993, EQC is restricted from communicating personal information, that is, information about an identifiable individual. While there may be an argument that information about a property or claim (not including the name of the claimant) is not personal information, claim information will often enable the claimant to be identified by searches of the land register and could therefore broadly be described as personal information. Given that the Privacy Commissioner typically takes a very broad view of what constitutes “personal information”, EQC starts from the presumption that claims information is personal information of the claimant.

However, EQC is able to release data in a form that does not enable an individual property owner from being identified. This is usually done by aggregating the data or displaying individuals’ claims on a small-scale map (at such resolution that individual properties can’t be identified).

EQC can release information as follows:

- Small-scale map data (these are also posted on EQC’s website after a significant event – as shown below);
- Data aggregated by postcode or local authority boundary;
- Specific property information if the requester has received the written permission of the property owner.

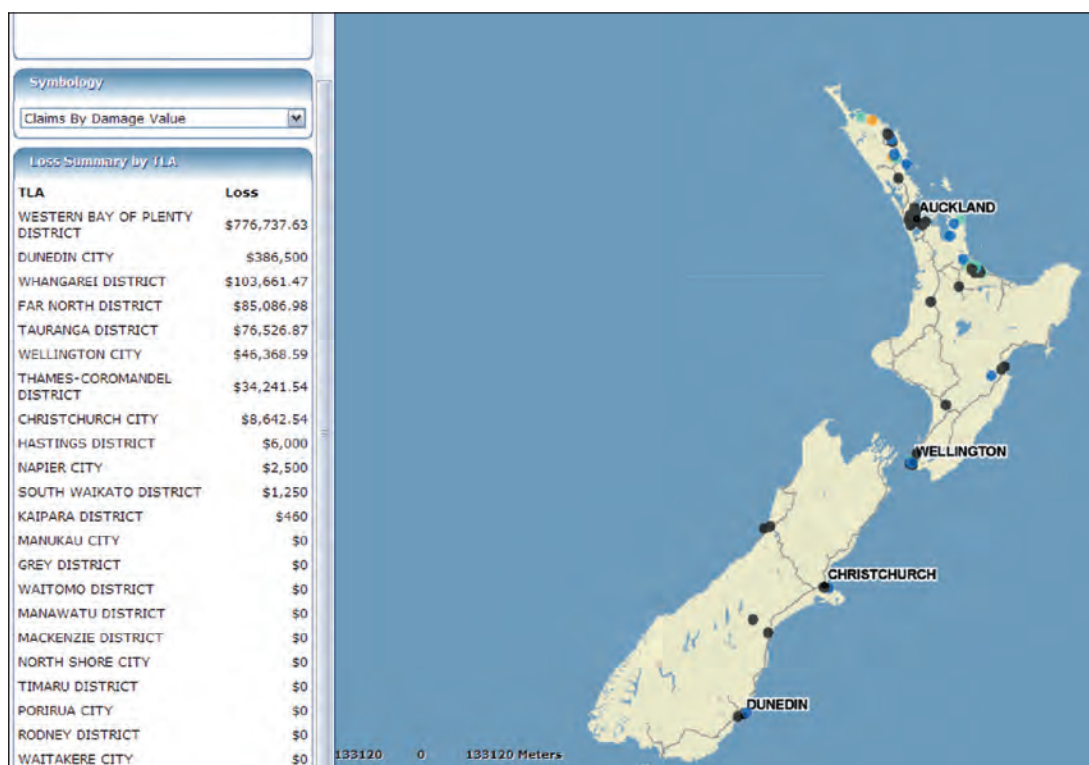


Figure 10: Total loss summaries by territorial local authority (TLA) illustrate the significance of slope stability impacts on land use in certain parts of New Zealand (image provided by EQC)

