HOW TO STOP BUILDING IN NATURAL HAZARD AREAS

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ABSTRACT (500 WORDS MAXIMUM)

How could buildings be allowed in dangerous flood areas or on unstable cliffs? Why are new developments still being built in natural hazard areas and what can be done about it?

It has taken multiple severe hazard events in 2023 which sadly caused loss of life and property, with serious financial consequences, for these questions to gain traction with media and politicians.

All the necessary tools to stop development in natural hazard areas already exist within the regulatory regime of the Local Government Act 2002, Resource Management Act 1991 (RMA), Building Act 2004, and NZ Building Code. With RMA Reform and Three Waters Reform legislation being repealed, engineers need to find better ways to work within the current legislation and to communicate natural hazard risks.

There are many multi-faceted reasons why consents are still being granted within natural hazard areas across the country, including:

- The suite of legislation is complex and interdependent
- Many elements need to be in place and understood across various professions for the system to work effectively
- There is no standard nation-wide approach to defining natural hazards, resulting in each Council defining hazards differently (eg using 1%AEP or 2%AEP flood events)
- Political will is often low when it comes to flagging properties as potentially subject to a natural hazard due to backlash from ratepayers
- Environment Court judges, RMA planners, and building consent managers often ignore or override the engineer's advice to 'avoid' the hazard, believing instead that it should be possible to 'mitigate' in any circumstance
- Poorly defined roles and differing approaches create an uncomfortable conflict zone within the RMA and Building Act regulatory regimes
- Human nature drives many aspects of the process down a dangerous route. Comments such as 'I've lived here 30 years and I've never seen a flood that high.' indicate an unwillingness to believe the expert's predictive flood models, catchment planning work, and geotechnical reports done to identify hazards.

Due to the integral connection between surface water and land stability, the onus is on the stormwater and geotechnical professionals collectively to improve the approach to natural hazard identification and communication. A cohesive multi-disciplinary approach is required to improve the assessments made for District Plans, resource consents, and building consents. Without change, the total liability for New Zealand will only increase.

Attitudes towards natural hazards have changed significantly during 2023. The public better understand that it is simply not safe for people to live in certain areas. The insurance industry is also driving change by shifting risk. A window of opportunity exists where there

is willingness to change the system to avoid a repeat of the tragic events in Auckland and Hawke's Bay.

Councils have a duty of care in assessing natural hazards and consents which creates long term liability. The potential quantum of liability from granting consents in high risk natural hazard areas needs to be better understood.

This paper provides a roadmap for stopping development in high risk natural hazard areas that can be implemented right now.

KEYWORDS

natural hazard, flooding, inundation, overland flow, building act, clause E1, resource management act, decline consent

PRESENTER PROFILE

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1 INTRODUCTION

How could buildings be allowed in dangerous flood areas or on unstable cliffs? Why are new developments still being built in natural hazard areas and what can be done about it?

It has taken multiple severe hazard events in 2023 which sadly caused loss of life and property, with serious financial consequences, for these questions to gain traction with media and politicians.

All the necessary tools to stop development in natural hazard areas already exist within the regulatory regime of the Local Government Act 2002 (LGA02), Resource Management Act 1991 (RMA91), Building Act 2004 (BA04), and NZ Building Code (NZBC). Unfortunately, these tools are often misunderstood and not implemented to their full extent.

With RMA Reform and Three Waters Reform legislation being repealed, focus will fall on local authorities and engineers to find better ways to work within the current legislation. They will need to communicate natural hazard risks in ways that are compatible with implementing the suite of legislation.

2 CURRENT CONTEXT

Aotearoa New Zealand is grappling with the impacts of having built quite extensively within natural hazard areas. Climate changes are increasing coastal erosion, and the frequency and intensity rainfall events causing flooding and associated land stability issues.

Attitudes towards natural hazards have changed significantly during 2023 due to multiple severe events in different parts of the country, like Muriwai in Auckland and Esk Valley in Hawkes Bay. The public now understand that it is simply not safe for people to live in certain areas. Politicians have felt the consequences to people and property, and the resulting financial impact. Auckland's 2023 plan to address flooding issues is a $1.65 billion

programme called 'Making Space for Water' (Auckland Council, 2023), giving some indication of the scale of the problem.

What became apparent during 2023 is that flood events impacted not only older houses, but also many newer subdivisions and dwellings that have been approved in recent times under the current legislative framework.

Since the 2011 Christchurch earthquake people have become familiar with 'red zones' and the idea of public buy-outs of private land that is no longer deemed safe to live on. Leaving landowners with land and debt, but no ability to rebuild a house to live in, is seen as detrimental to society as a whole. While insurance has its place, owners badly affected by flooding are also demanding that public funds be used as a solution to move them to safety.

Recovery plans including buy-outs have been formulated under emergency conditions in the aftermath of an event. This can provide immediate relief, but it can also set an unaffordable precedent, especially amid changing global conditions that are predicted to cause more frequent adverse events.

A window of opportunity exists where there is public and political willingness to tighten the system to avoid a repeat of the tragic events of 2023 in Auckland and Hawke's Bay. Limited understanding of the complex natural hazards framework makes this more challenging.

There is urgency to make changes as quickly as possible to avoid the liability increasing to unsustainable levels across the country. Systemic changes take many years, sometimes decades to implement. With consents being valid for many years, it will take an equally long time for changes made now to have a real impact on physical developments.

2.1 CURRENT AVAILABLE NATURAL HAZARD INFORMATION

Operating under the Crown Research Institutes Act 1992, CRI's conduct scientific research, pursue excellence, and apply research results to technological developments for the benefit of New Zealand. CRI's publishing information related to Natural Hazards include:

- GNS Science Te Pū Ao – GNS undertakes earth and material sciences research on earthquakes, volcanoes, landslides, tsunami, building resilience, and more generally environment and climate. (GNS, 2024)
- National Institute of Water and Atmospheric Research – NIWA's purpose is to… provide understanding of climate and the atmosphere and increase resilience to weather and climate hazards to improve safety and wellbeing. (NIWA, 2024)
- Manaaki Whenua Landcare Research – MWLR conducts science and research for land and environment focused on environmental issues, opportunities, and solutions. (MWLR, 2024)
- EQC Toka Tū Ake – EQC is a crown entity investing in natural disaster research to help communities reduce their risks. EQC publishes a Natural Hazards Portal (https://www.naturalhazardsportal.govt.nz/s/) which provides links to Local Authority information. It also provides information about how previous events have impacted property by looking at past disasters and EQCover claims. (EQC, 2024)

EQC, GNS, and LINZ (Land Information NZ) collaborate to publish GeoNet (https://www.geonet.org.nz/) which contains historic data, and monitors the current state for Earthquake, Landslide, Tsunami, and Volcanic Risks.

Information provided by CRI's forms the basis for setting policy and guidance. Further studies at regional and local scales, are published through Local Authority channels. CRI's research matters of global and national significance, while local datasets on land stability and inundation (eg flooding) hazards are resourced by regional and local councils.

2.2 NATIONAL GUIDANCE

There is little nationally consistent guidance on how to assess natural hazards, or who should hold the liability when land becomes unsafe for people to live on. Although some national datasets are published as outlined in 2.1 above, there is heavy reliance on local authorities to gather and record information, and to administer outcomes.

2.2.1 NATIONAL POLICY AND DIRECTION FOR NATURAL HAZARDS

The Ministry for the Environment (MfE) advises in a February 2024 update (MfE, 2024) that it has been scoping two proposed pieces of national direction to reduce the risk to people and property from natural hazards like flooding, landslips, and coastal inundation, which are:

- National Policy Statement - Natural Hazard Decision-making (NPS-NHD) – will set out how local authorities should consider natural hazard risk when making decisions on regional policy statements, regional plans, district plans, and resource consents relating to new developments. It is expected to 1) limit new building in areas that are at high risk from natural hazards, and 2) require actions to reduce risk for areas at moderate risk.
- National direction for natural hazards – a more comprehensive national direction which will support councils to consistently identify and plan for the risks posed by natural hazards. If progressed, the national direction would be developed within 2 years.

NPS-NHD work is limited to the RMA91 framework, but MfE has recognised that multiple government agencies are involved and identified a broader work programme (MfE, 2023) that, if progressed, may assist to resolve some of the issues identified in this paper.

MfE's work programme was linked to RMA Reforms which have been repealed or stopped by the current government. NPS-NHD has been out to consultation and has the status of a Proposed NPS, however it is still somewhat unclear the true extent of work that has been cancelled or impacted due to repeals.

Encouragingly the NPS-NHD supports the use of nature-based solutions and comprehensive area-wide solutions for risk reduction.

The Proposed NPS-NHD is seen as an interim step that will have some impact, but the national direction would provide the detail. Commitment to complete all this work has not yet been made, and if completed would take many years to implement. This still leaves wider outcomes at the mercy of individual councils working within the current framework.

2.2.2 LIQUEFACTION GUIDANCE

Learnings from the 2011 Christchurch earthquake about liquefaction as a natural hazard have been turned into a comprehensive document by MBIE titled Planning and Engineering Guidance for Potentially Liquefaction-prone Land. It includes details for investigations, analysis, and risk management through the use of RMA91 and BA04 that would be useful for other hazard assessments. (MBIE, 2017)

2.2.3 GUIDANCE ON BUILDING ACT NATURAL HAZARD PROVISIONS

The Ministry of Business, Innovation and Employment published in October 2023 guidance on complying with Sections 71 to 74 of BA04 (MBIE, 2023) which uses flooding as an example, and has a good overview.

The MBIE guidance is written, however, within a narrow view of BA04 and fails to mention some key components of the total natural hazards system such as the decision-making role of the Territorial Authority (and NUO) under s71 and s72.

Of concern is that the guidance includes diagrams that show houses built within the flooded areas, and with floor levels inundated during a 1%AEP event!

2.3 INSURANCE FOR NATURAL DISASTERS

Aotearoa New Zealand has two tiers of insurance - government natural disaster insurance, and private insurance of property assets.

2.3.1 EQC TOKA TŪ AKE

EQC is legislated through the Earthquake Commission Act 1993 (EQCA93). In addition to research, it provides home insurance to help communities get their lives back on track after an event. EQCover insurance is for damage from natural disasters like earthquakes, volcanic and geothermal activity, tsunami, landslips, storms or flooding, and fire resulting from any of these. EQCover is capped and is complementary to private insurance for buildings and contents. (EQC, 2024)

Multiple natural disasters have occurred since the 1993 Act, prompting an enquiry and review that has resulted in the new Natural Hazards Insurance Act 2023 which comes into effect 1 July 2024 and replaces the EQCA93. After 1 July 2024 EQC will become known as the Natural Hazards Commission Toka Tū Ake. (EQC, 2024)

2.3.2 PRIVATE INSURANCE AND INDUSTRY RESPONSES

The private insurance industry is driving some change by shifting risk. More questions are asked about natural hazard risks before insurance is provided. Insurance premiums continue to rise across the country in response to the scale of insurance claims. In some cases insurance may be denied if the risks are deemed too high for the insurer’s business.

Banks and mortgage lenders also play a part in driving change by refusing to lend against uninsurable properties or properties at risk of damage within the mortgage period. The impact here is that only cash buyers could participate in the purchase of such properties, and ultimately property values fall if there are limited willing buyers.

These types of decisions by insurers and lenders, however, are at the end of a long chain of decision-making about land use, natural hazards, and issuing consents for development.

3 HOW DID WE GET HERE?

There are many multi-faceted reasons why consents were, and still are, being granted within natural hazard areas across the country, including:

- The suite of legislation is complex and interdependent
- Many elements need to be in place and understood across various professions for the system to limit development effectively
- There is no standard nation-wide approach to defining natural hazards, resulting in each Council defining hazards differently (eg using 1%AEP or 2%AEP flood events)
- Political will is often low when it comes to flagging properties as potentially subject to a natural hazard due to backlash from ratepayers

- Environment Court judges, RMA planners, and building consent managers often ignore or override the engineer's advice to 'avoid' the hazard, believing instead that it should be possible to 'mitigate' in any circumstance
- Poorly defined roles and differing approaches create an uncomfortable conflict zone within the RMA and Building Act regulatory regimes
- Human nature drives many aspects of the process down a dangerous route. Comments such as 'I've lived here 30 years and I've never seen a flood that high.' indicate an unwillingness to believe the expert's predictive flood models, catchment planning work, and geotechnical reports done to identify hazards.

4 DUTY OF CARE & LONG-TERM LIABILITY

Local authorities have a 'duty of care' in discharging their responsibilities under legislation.

Definition:
Duty of care means there is a moral and legal (common law) obligation to ensure the safety or well-being of others including to maintain reasonable care to avoid careless acts that could foreseeably harm others. This can also be described as a social contract with responsibility to the whole of the public within the relevant jurisdiction to manage in a competent manner, and extends to making decisions that protect people and property in a way that minimises impacts such as financial loss and hardship in the future. (*Wikipedia, 2024 and Oxford Dictionary*)

For natural hazards this means undertaking adequate work to identify and plan for known hazards, and to avoid development in high risk areas where devastating loss to communities could occur. Professionals such as engineers also have a duty of care in undertaking their work.

A failure to demonstrate duty of care through statutory planning, record keeping, robust process, competency, and informed decision-making can create a long-term liability for local government. If developed land is subsequently deemed unbuildable, the liability could manifest as financial compensation for expenses and potentially having to purchase the land and buildings using public funds for little actual public benefit.

With natural hazards this duty of care and long-term liability is limited by the information known at the time of making the decisions. For example, no liability is created for a building that was consented under previous legislation and the hazards known at the time, based on the specifications of the day.

Local authorities inherit the liabilities of their predecessors so there is no getting away from this problem. When long-term liability is multiplied over decades, the consequences to ratepayers can be widespread. Reputation damage and erosion of trust occurs after repeated events because that money could have been spent elsewhere in the community.

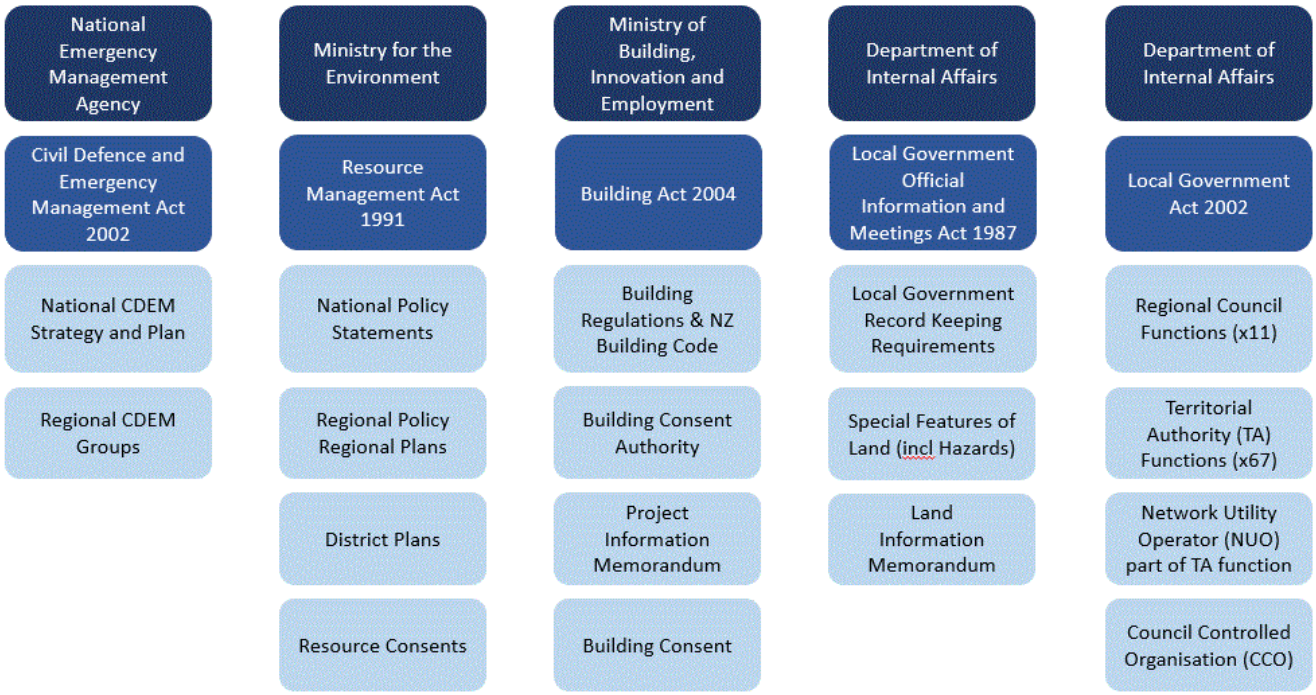
Local authorities need to carefully examine their current processes in the context of demonstrating duty of care in natural hazard management in order to reduce long-term liability to the maximum extent possible.

The potential quantum of liability from existing developments and granting consents for new development in high risk natural hazard areas needs to be better understood. For this to happen data need to be collected and shared across entities and industries, such as insurance and emergency response.

5 OUTLINE OF NATURAL HAZARD LEGISLATION

The suite of legislation is interdependent when it comes to natural hazards. There are many elements that need to be in place, for many different natural hazards. It also necessitates many professions bringing their expertise together for common outcomes across policy, planning, consenting, and compliance.

Figure 1 shows that there are five pieces of legislation, four government agencies, and the 78 Local Authorities that are involved with natural hazard management in Aotearoa New Zealand. Interdependencies arise because each piece of legislation refers to the other and relies on the effective use of powers and tools under each Act to work together.



Created by Shelley Wharton (adapted from the Planning and Engineering Guidance for Potentially Liquefaction-prone Land, MBIE, 2017)

Figure 1 Legislation Outline – Hazards

5.1 UNDERLYING PRINCIPLES

When all the relevant legislation is read together it becomes apparent that a number of underlying principles have informed each piece of legislation. These principles are based around logic, risk management, keeping people safe, and minimising losses across the country. These principles include:

- Identify natural hazards at national, regional, and local level
- Record and share hazard information to allow people to plan accordingly
- Zone land as appropriate to the hazards and risks
- Use all the tools available to protect natural systems and their function in hazard management
- Use all the tools available to keep development away from known natural hazard areas (eg policies, rules, standards, requiring esplanade reserves)
- The ability to decline consents if hazards and risks would be increased
- The ability to approve consents in natural hazard areas only if hazards and risks would not be increased, and to shift appropriate liability to the property owner if damage does occur.

5.2 HIERARCHY AND INTENT

An underlying assumption across the legislation in Figure 1 is that certain things will be done in a hierarchy, and that it leads to the outcomes desired as shown in Figure 2.

Figure 2 Planning & Consenting Hierarchy

The reality is that many parts happen at the same time, and sometimes at odds with each other. Gaps can open in the system which are made worse if silos form across the different professions that are responsible for natural hazard outcomes.

5.3 NATURAL HAZARD DEFINITIONS

Various natural hazard definitions exist across the suite of legislation as follows.

5.3.1 RESOURCE MANAGEMENT ACT 1991

Legislation Extract from RMA91:
Part 1 s(2) Interpretation: natural hazard means any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects… human life, property, or other aspects of the environment.

This wide-ranging definition is necessary for policy and planning at national scales to influence regional and local planning. It also allows for the inclusion of information at a global scale such as changing temperatures or rain patterns that could lead to increased or decreased natural hazards over time.

5.3.2 LOCAL GOVERNMENT ACT 2002

Section 5 Interpretation of the LGA02 says that natural hazard has the same definition as the RMA91 (see 5.3.1).

5.3.3 CIVIL DEFENCE AND EMERGENCY MANAGEMENT ACT 2002

Legislation Extract from CDEMA02:
Section 4 Interpretation states that:

- **risk** means the likelihood and consequences of a hazard
- **hazard** means something that may cause, or contribute substantially to the cause of, an emergency
- **emergency** means a situation that-
  - (a) is the result of any happening, whether natural or otherwise, including, without limitation, any explosion, earthquake, eruption, tsunami, land movement, flood, storm, tornado, cyclone, serious fire, leakage or spillage of any dangerous gas or substance,… failure of or disruption to an emergency service or a lifeline utility,…; and
  - (b) causes or many cause loss of life or injury or illness or distress or in any way endangers the safety of the public or property in… any part of New Zealand; and
  - (c) cannot be dealt with by emergency services…

CDEMA02 includes similar hazards to RMA91, and more to enable emergency response.

5.3.4 BUILDING ACT 2004

Legislation Extract from BA04:
Section 71(3) of the Building Act 2004 (BA04) defines a natural hazard as any of the following:

- (a) erosion (including coastal, bank, sheet erosion)
- (b) falling debris (including soil, rock, snow, and ice)
- (c) subsidence
- (d) inundation (including flooding, overland flow, storm surge, tidal effects, and ponding)
- (e) slippage

In contrast to the RMA91 these natural hazards are more localised, and of course relevant to the potential to damage smaller numbers of properties or harm less people.

5.3.5 LOCAL GOVERNMENT OFFICIAL INFORMATION AND MEETINGS ACT 1987

Although Local Government Official Information and Meetings Act 1987 (LGOIMA87) does not use the terminology 'natural hazard' it does cover 'matters affecting any land' that are consistent with other natural hazard definitions.

Legislation Extract from LGOIMA87:
Section 44A on Land Information Memorandum includes the matters which shall be included in the [LIM] are 44A(2)(a) each 'special feature or characteristic of the land concerned': including, but not limited to, potential erosion, avulsion, falling debris, subsidence, slippage, alluvion, or inundation… that (i) is known to the TA, but (ii) is not apparent from the… district plan…

Special Features are worth noting as a tool in a wider sense because this can relate to any matter that needs to be informed to a property owner through a LIM or PIM to be used in assessing building consents. These can be, among other things, known or likely natural hazards, hazard mitigations such as minimum finished floor level, or NUO service restrictions including requirements of connecting to a network such as the need for an on-site mitigation device.

5.4 THE RANGE OF NATURAL HAZARDS

As can be seen above and in Table 1 there is an extensive list of natural hazards across all these Acts, and potentially others that exist elsewhere. The most comprehensive definition is in the RMA91 and therefore LGA02 and LGOIMA87 through local government record keeping and disclosure requirements.

Natural Hazard	Legislation
Earthquake	RMA91, LGA02, CDEMA02
Tsunami	RMA91, LGA02, CDEMA02
Volcanic and Geothermal Activity Eruption	RMA91, LGA02 CDEMA02
Wind Storm, Tornado, Cyclone	RMA91, LGA02 CDEMA02
Drought	RMA91, LGA02
Fire	RMA91, LGA02, CDEMA02
Landslip, Subsidence Slippage, Falling Debris (including soil, rock, snow, ice) Land Movement Slippage, Subsidence, Falling Debris	RMA91, LGA02 BA04 CDEMA02 LGOIMA87
Liquefaction (MBIE advised TA's to assess liquefaction as a hazard in 2019)	
Erosion, Sedimentation Erosion (including coastal, bank, sheet erosion) Land Movement Erosion, Alluvion	RMA91, LGA02 BA04 CDEMA02 LGOIMA87
Flooding (and the wider context of any atmospheric or earth or water related occurrence) Inundation (including flooding, overland flow, storm surge, tidal effects, and ponding) Flood, Storm, Tornado, Cyclone Inundation, Avulsion	RMA91, LGA02 BA04 CDEMA02 LGOIMA87

Table 1: Complete List of Natural Hazards Referenced in Legislation

Table 1 shows the wide array of natural hazard names and associated definitions when it comes to land stability and surface water. This can cause confusion and legal technicalities due to naming conventions when it comes to documenting hazard assessments.

5.4.1 WHAT HAPPENS WITH SO MANY DEFINITIONS?

With the same definitions applying to the LGA02 and RMA91 there can be certainty about those being standard to all local authorities. The list under BA04 is quite different, meaning that additional datasets are required to be added to the list.

What is missing is the further definition of how to assess the hazards and on what basis to assign significance of risks in a consistent manner. There is also a lack of clarity about whose responsibility it is to define the natural hazards at national, regional, or local scales.

Some of the definitions are exactly the same in both Acts (ie subsidence), some are similar (ie landslip and slippage), and others overlap somewhat (ie flooding and inundation). It is inefficient and costly if multiple agencies are creating similar datasets. It also creates uncertainty about which data to rely on.

A variety of expertise is needed to cover so many hazard definitions. Some of the RMA91 natural hazards can be assessed and mitigated (to a point) at a national level such as earthquakes, tsunami, volcanic and geothermal activity, and major storms.

The work required of local authorities to assess and maintain records on all these hazards is extensive. Only the largest local authorities could afford to possess in-house capability to undertake natural hazard work to the extent required, while still relying on consultants for in-depth expertise and site investigations. What must be avoided is for 78 local authorities to each create different methods for identifying and assessing hazards, and describing risks.

The ongoing workload on assessing individual consents is also considerable due to the current methods of regulating natural hazards, which is generally a soft approach. This increases the costs for ratepayers and for developers.

National guidance is essential for efficient use of public funds, and consistency of information for the many professionals who work across the country.

6 LEGISLATION AND REGULATION ANALYSIS

Since the main audience of this paper is likely to be professionals in the water industry, the following sections are limited to discussion about the natural hazards at a regional and local level relating to land stability and surface water.

6.1 WHO NEEDS TO BE INVOLVED?

Each piece of legislation covered in this paper is administered or implemented by a different government agency or organisation as shown in Table 2 below.

Table 2 further demonstrates the imperative for national direction on natural hazards to achieve consistency across so many pieces of legislation, agencies, and organisations.

Legislation	Government Agency	Implementation Organisations
Resource Management Act 1991	Ministry for the Environment (MfE)	Regional Councils, Territorial Authorities, Network Utility Operators
Local Government Act 2002	Department of Internal Affairs (DIA)	Regional Councils, Territorial Authorities, Network Utility Operators
Civil Defence and Emergency Management Act 2002	National Emergency Management Agency (NEMA)	NEMA, Regional Councils, Territorial Authorities, Network Utility Operators
Building Act 2004	Ministry of Building, Innovation and Employment (MBIE)	Regional Councils, Territorial Authorities, Network Utility Operators, Building Consent Authorities
Local Government Official Information and Meetings Act 1987	Department of Internal Affairs (DIA)	Regional Councils, Territorial Authorities, Network Utility Operators, Council Controlled Organisations (who are NUO's)

Table 2: Roles in Natural Hazard Management

6.2 RESOURCE MANAGEMENT ACT 1991 IMPLEMENTATION

6.2.1 PURPOSE

Legislation Extract from RMA91:
Within Part 1 the purpose of the RMA91 as it relates to natural hazards includes s5(1) sustainable management of natural and physical resources… s5(2) in a way… which enables people and communities to provide for their… wellbeing and for their health and safety while… s5(2)(a) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and s5(2)(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and s5(2)(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

Consideration of wellbeing, health, and safety is critical in planning for and managing natural hazards. Safety is relatively well understood, but the wellbeing and health consequences related to damp buildings or the ongoing stress of being subjected to repeated hazard events, damage and loss are rarely considered.

6.2.2 MATTERS OF NATIONAL IMPORTANCE

Legislation Extract from RMA91:
Part 1 Matters of national importance includes s6(h) the management of significant risks from natural hazards.

There is no definition of significant risks, so those identifying and assessing risk need to assign significance based on the national, regional, or local context. Assessment should include where risks would accumulate to a level of significance.

6.2.3 REGIONAL AND DISTRICT FUNCTIONS

Legislation Extract from RMA91:
The functions of regional councils includes s30(1)(c) the control of the use of land for the purpose of… (iv) the avoidance or mitigation of natural hazards… and s30(1)(gb) the strategic integration of infrastructure with land use through objectives, policies, and methods.

The functions of territorial authorities (TA's) includes s31(1)(a)… objectives, policies, and methods to achieve integrated management of the effects of… land use; and (b) the control of any actual or potential effects of the use… of land including for the purpose of (i) the avoidance or mitigation of natural hazards.

S35(1) requires local authorities to gather information, and undertake research as necessary to carry out effectively its functions… and s35(3) outlines that relevant information shall be kept to enable the public (a) to be better informed… of [the local authority's] duties and functions… and (b) to participate effectively…

S35(5) states that the local authority shall keep information on… (j) records of natural hazards to the extent that the local authority considers appropriate for the effective discharge of its functions…

There is overlap between the functions and requirements of regional and local authorities which needs to be addressed by MfE. Potentially this will be resolved through coordination and membership of Regional CDEM Groups.

Implementation issues arise from the overlap, for example regional consents for earthworks that do not adequately consider overland flowpaths managed by the NUO, but it is the TA and NUO who are then expected to fix the problems arising on site.

6.2.4 PROTECTION OF OTHER PROPERTY

Legislation Extract from RMA91:
Protection of *other property* is covered in s68(2A) Regional Rules and s76(2A) District Rules, with both containing the same wording as follows:

> 'Rules may be made under this section for the protection of *other property* (as defined in s7 BA04) from the effects of *surface water*, which require persons undertaking *building work* to achieve performance criteria additional to, or more restrictive than, those specified in the building code as defined in s7 BA04.'

Both s68(3) and s76(3) say:

> 'In making a rule, the [relevant] council shall have regard to the actual or potential effect on the environment of activities, including, in particular, any adverse effect.'

Other property also forms a part of natural hazard and surface water assessments in BA04 and NZBC which is covered further in 6.6 below.

In some cases the TA owns the 'other property' for public benefit including roads, utilities, parks, esplanades, and land required for natural hazard management, so it is prudent to have adequate rules to protect the TA's assets.

6.2.5 ESPLANADE RESERVES AND ESPLANADE STRIPS

Esplanades have many purposes and are an important part of catchment management, land use planning, and natural hazard management.

Legislation Extract from RMA91:
Section 229 states that an esplanade has 1 or more of the following purposes (a)… protection of conservation values by… (a)(i)… natural functioning of adjacent sea, river, or lake; or… water quality; or… aquatic habitats; or… natural values; or mitigating natural hazards; or to enable public access…; or to enable public recreational use… where the use is compatible with conservation values.

There is a common misconception that esplanade width is determined by a simplistic measurement of 20 metres from the edge of the normally flowing water or top of the stream bank. The esplanade requirement actually needs to be determined by hydrological analysis of the river bed width.

Where the river bed is an average of 3.0 metres width during *mean annual* flow (MAF), the 20 metre measurement is taken from the furthest extent of the MAF. This has been well documented in the Environment Court Decision No. W 78/2004, and in the paper titled 'How Wide is the Stream?' (Stumbles *et al.*, 2008) where the MAF was found to correlate to a 2.3 year Annual Recurrence Interval (ARI).

Esplanade requirements are the only reference to MAF, ARI, or river bed width as a determining factor in relation to natural hazards. The analysis method is more complex but is generally limited to the lower reaches of catchments. The need for averages in this case is understandable to avoid disconnected esplanade reserves and to ensure the esplanade width is sufficient for its purpose in the long-term.

6.2.6 REFUSAL OF SUBDIVISION CONSENT

Legislation Extract from RMA91:
Section 106(1)(a) provides the consent authority the ability to refuse a subdivision consent if it considers that there is a significant risk from natural hazards. It also may decide to grant a subdivision consent subject to conditions following an assessment under s106(1A) of the risk from natural hazards, which is a combination of:

(a) The likelihood of natural hazards occurring (whether individually or in combination); and
(b) The material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
(c) Any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b)

Although planners focus on the s104 assessment in great depth, they seem to be largely unaware of the provisions of s106 and in my experience reluctant to use them. S87A(2)(a) actually provides for s106 to override the need to grant a controlled activity consent indicating the importance of avoiding significant risk from natural hazards.

There is no definition of 'significant risk' so the stormwater, hydrology, and geotechnical professions need to work closely together to determine what constitutes significant risk and document it separately in hazard registers or maps.

The planning profession needs to understand and use s87A(2)(a) and s106 to its full effect, with the expert assessments provided through those who create flood models, catchment management planning information and geotechnical risk reports.

6.2.7 IDENTIFICATION OF A BUILDING PLATFORM FOR SUBDIVISION

The practice of identifying a building platform on each proposed subdivision Lot must include an assessment of natural hazards. To create a new Lot requires a buildable area that is free from natural hazards to the extent that a building consent would definitely not be refused under BA04 s71. Not doing this at subdivision stage substantially increases the potential long-term liability to local authorities. Any restrictions applying to the site must be included in a consent notice on the certificate of title.

6.2.8 PUBLIC CONSULTATION AND HAZARD MANAGEMENT

Legislation relating to natural hazards contains a directive approach. This works well for directing agencies and local authorities to do work, keep records, and regulate except where the RMA91 is concerned. Natural hazard information provided through district plan change processes or resource consents becomes the subject of public consultation, hearings, commissioner or elected member decision-making, appeals, legal challenge, and environment court judges.

Relying so heavily on the RMA causes issues because it is administered by resource planners who are generally not familiar with the details of natural hazard management.

Historic and current soft practices have led to a perception that making rules to 'Avoid' the hazard is a reduction in developable area and a financial hardship on the owner. This is untrue since the hazard exists regardless of the wording in a district plan. There is also reluctance to wait for rezoning until the 'Remedy', which is often a council capital project or programme of work, has reduced the hazard to acceptable levels.

Owners who seek to profit from their short-term property investment see merit in spending money on legal challenges that historically have proven successful in reducing the firmness of natural hazard rules. Local authorities have limited public funds and expert resources to withstand multiple lengthy legal challenges, so natural hazards are reduced to 'overlays' with little or no zoning rules to enable clear reductions of development in these areas.

The prevalent assumption amongst planners and the environment court is that any hazard can be mitigated at an individual site level, so that decision should be left to a resource consent or building consent. Unfortunately, this attitude just pushes the issue into the future, but by then the stakes are higher and tensions rise. Once lodged there is little appetite to decline subdivision, land use, or building consents.

Too much reliance on the RMA for implementation reduces the ability of the local authority to fulfil its responsibilities under the other legislation.

6.3 LOCAL GOVERNMENT ACT 2002 IMPLEMENTATION

Legislation Extract from LGA02:
The specific responsibility in relation to natural hazards under LGA02 is s101B which requires a local authority to prepare a 30 year Infrastructure Strategy as part of its Long Term Plan. S101B(3) requires that the Infrastructure Strategy must outline how the local authority intends to manage its infrastructure assets, taking into account the need to… (e) provide for the resilience of infrastructure assets by identifying and managing risks relating to natural hazards and by making appropriate financial provisions for those risks.

Catchment planning done by the NUO provides the substantive content of the Infrastructure Strategy in relation to resilience and natural hazard risks. Methods to manage assets should include the regulatory compliance mechanisms needed to achieve catchment and asset outcomes.

This longer-term planning requirement reflects that land and infrastructure assets have a long life, sometimes in excess of 100 years, and provide wide public benefits.

6.3.1 THE ROLE OF BYLAWS IN NATURAL HAZARD MANAGEMENT

Legislation Extract from LGA02:
Section 145 gives TA's bylaw-making power for (a) protecting the public from nuisance, (b) protecting, promoting, and maintaining public health and safety… s146(1) specifies the bylaw can be for the purposes: (b) of managing, regulating against, or protecting from, damage, misuse, or loss, or for preventing the use of, the land, structures, or infrastructure associated with… (iii)… drainage…, (iv) land drainage,… (vi) reserves… or other land under the control of the TA… (4)… relating to a stormwater networks… give effect to any stormwater environmental performance standards...

Drainage or stormwater networks can comprise both natural and man-made drainage systems. When those networks also have a hazard management function, such as overland flowpaths, the TA has a responsibility to protect and regulate the use of those systems. In some cases, the stormwater network is the 'Remedy' or 'Mitigation' to environmental effects or hazards in the catchment.

Bylaws are the best regulatory tool for implementation of:

- Engineering or Land Development Standards including local natural hazard assessment specifications (ie using 100 year ARI event for flooding)
- Delegating down to site level the compliance requirements contained in catchment plans and regional network consents
- Requiring approvals to connect or work near NUO assets, and setting conditions for mitigation outside the RMA provisions
- Outfall requirements associated with NZBC Clause E1, including land stability
- Managing asset impacts, damage or interference
- Ongoing compliance on private properties, alongside resource and building consents

When complaints are received about nuisance or damage the local authority needs a regulatory avenue outside of BA04 and RMA91 to address non-compliance. One example of this is works on private property that block or divert an overland flowpath so that it impacts other property. Another example is the storage of materials in floodplains which would get washed away in a flood event and eventually block streams, pollute water, damage property, or create a public health risk.

The compliance area is often poorly supported and resourced. It can be difficult to staff what can be an unpleasant job. For compliance officers to enforce they require access to technical staff who can clearly outline the issues, impacts, and solutions in catchment and regulatory terms, as well as provide evidence in court if needed.

6.4 CIVIL DEFENCE AND EMERGENCY MANAGEMENT ACT 2002 IMPLEMENTATION

Legislation Extract from CDEMA02:
The purpose in s3 is to (a) improve and promote the sustainable management of hazards (as defined in this Act) in a way that contributes to the social, economic, cultural, and environmental well-being and safety of the public and also to the protection of property; and (b) encourage and enable communities to achieve acceptable levels of risk…; and (d) require local authorities to coordinate, through regional groups, planning, programmes, and activities related to CDEM across the areas of reduction, readiness, response, and recovery, and encourage cooperation and joint action within those regional groups...

Section 13(1) requires every local authority to be a member of a CDEM Group. S17(1)(a) details that the functions of a CDEM Group, and of each member are to (i) identify, assess, and manage [relevant] hazards and risks; (ii) consult and communicate about risks; identify and implement cost-effective risk reduction… and (g)… promote and raise public awareness of, and compliance with, this Act… and (h) monitor and report on compliance… with this Act.

NEMA, as the administrator of CDEMA02, will play an active role in lifting performance of local authorities in hazard management through hazard identification, risk reduction, preparedness planning, communication, and reporting. NEMA resources have been increased to enable this work to move ahead faster across the country. Local authorities will have to respond accordingly.

6.5 LOCAL GOVERNMENT OFFICIAL INFORMATION AND MEETINGS ACT 1987 IMPLEMENTATION

Legislation Extract from LGOIMA87:
Section 44A(1) Land Information Memorandum (LIM) says that a person may apply to a TA for a LIM in relation to matters affecting any land in the district of the authority.

Section 44A(2) states the matters which shall be included in a LIM are (extract below is for relevance to natural hazards only):

(a) information identifying each special feature or characteristic of the land concerned, including but not limited to potential erosion, avulsion, falling debris, subsidence, slippage, alluvion, or inundation, or likely presence of hazardous contaminants, being a feature that (i) is known to the TA; but (ii) is not apparent from… a district plan under the RMA91.
(b) Information on private and public stormwater… drains as shown in the TA's records;…
(h) any information which has been notified to the TA by any NUO pursuant to the Building Act.

Section 44A(3) allows inclusion in a LIM of any other information concerning the land that the authority considers… to be relevant.

Section 44A(6) says that… there shall be no grounds for the TA to withhold information specified in terms of subsection (2) or to refuse to provide a LIM where this has been requested.

Once information is 'known' to the TA, it has a responsibility to record it (including any limitations as to accuracy), and then to disclose it on LIMs and PIMs. Notification from a central government agency or regional council to a TA about new natural hazard datasets is sufficient to create the link to 'known' information.

Issues arise if there is reluctance to record 'known' information against properties because of negative consequences from unhappy owners and the threat of legal action. A lack of clarity about whether creating a new record on a property triggers a need to inform the property owner is part of the problem. The alternative is that they find out when a LIM or PIM is next issued for the property, which is usually when they intend to sell and are in a heightened stress situation.

6.6 BUILDING ACT 2004 IMPLEMENTATION

Under BA04 the definition of '*building work'* includes '*sitework'* which means earthworks in preparation for or associated with construction of a building. It is important to keep in mind this definition while reading this part because it is often the sitework which is problematic in causing *nuisance* or exacerbating natural hazards by changing surface water patterns within and outside the subject site.

6.6.1 PURPOSE OF BA04

Legislation Extract from BA04:
Section 3 has a purpose (in relation to natural hazards) of (a) to provide for the regulation of building work,… and the setting of performance standards for buildings to ensure that (i) people who use buildings can do so safely and without endangering their health…and (b) to promote the accountability of owners, designers, builders, and building consent authorities who have responsibilities for ensuring that building work complies with the Building Code.

Often overlooked is that surface water under buildings can endanger people's health through repeated events causing dampness and mold. Safety can be impacted through people's innate need to escape from perceived imminent danger, for example by entering dangerous floodwaters when they are nearing the building.

6.6.2 PROJECT INFORMATION MEMORANDUM & NATURAL HAZARDS

Legislation Extract from BA04:
Subpart 3 s31(1) requires that a Building Consent Authority (BCA) must (a)… apply for a Project Information Memorandum (PIM) to the TA…; and (b)… provide a copy of the PIM to the owner… unless (2) the BCA is also the TA.

Section 33 outlines the content of a PIM application including s33(1)(b) any information that the TA reasonably requires in relation to authorisations or requirements that (i) the TA is authorised to refuse or impose under any Act (except BA04); and (ii) are likely to be relevant to the design and construction of the proposed building; and (c) any other information that the TA (acting as agent for a NUO by prior agreement with that NUO) requires in respect of proposed connections to public utilities…

Section 33(3) further clarifies the authorisations and requirements include, without limitation,… (c) provisions to be made… (iii) for disposing of stormwater…; and (d) precautions to be taken if building work is carried out over and existing drains…

These provisions are important in enabling the TA and NUO to meet their responsibilities and manage impacts on the whole of the integrated stormwater network including primary and secondary networks. BCA's are not able to work in isolation of the rest of the TA and NUO because they need to enable their authorisations and requirements in processing building consents, whether a PIM is issued or not. The provision in s31(2) relies however on the TA, NUO, and BCA having adequate internal process to communicate all necessary information.

6.6.3 S71 & REFUSAL OF BUILDING CONSENT

Legislation Extract from BA04:
Section 71(1) states that the BCA must refuse to grant a building consent for construction of a building, or major alterations to a building, if:

(a) the land… is or is likely to be subject to 1 or more natural hazards, or
(b) the building work is likely to accelerate, worsen, or result in a natural hazard on that land or any other property.

However, subsection (1) does not apply if the BCA is satisfied that adequate provision has been or will be made to:

(a) protect the land, building work, or other property… from the natural hazard or hazards, or
(b) restore any damage to that land or other property as a result of the building work.

Triggering s71 requires a relevant hazard entry on the PIM. The wording of s71 does not relate to risk language used elsewhere, but to the need for a specific assessment, by a competent person. Protection of other property is covered in 6.2.4 above.

6.6.4 S72 GRANTING & WAIVER OR MODIFICATION OF BUILDING CODE

Legislation Extract from BA04:
Section 72 states that a TA must grant a building consent on land subject to natural hazards if it considers that:

(a) The building work… will not accelerate, worsen, or result in a natural hazard on the land on which the building work is to be carried out or any other property; and
(b) The land is subject to 1 or more natural hazards; and
(c) It is reasonable to grant a waiver or modification of the Building Code in respect of the natural hazard concerned.

Waiver or modification of the building code would potentially be required in relation to Clause B1 Structure, Clause B2 Durability, and/or Clause E1 Surface Water depending on the works proposed and result of the assessment. The fact that a waiver or modification is needed, indicates a basic premise that the Building Act does not envisage the regular granting of consents for *building work* in natural hazard areas.

Under BA04 s12(1) and (2) only a TA can issue a waiver or modification of the NZBC and issue PIMs. Any BCA that is not a TA is therefore <u>not</u> able to issue building consents for works on land subject to a natural hazard in isolation.

6.6.5 S73 & S74 NOTIFICATIONS AND TRANSFER OF LONG-TERM LIABILITY

Legislation Extract from BA04:
If a decision is made to grant a building consent under s72, then s73(1) states that a condition of consent must be included that the BCA will, on issuing the consent, notify the consent to:

(a) in the case of an application made by… the Crown, the appropriate Minister and the Surveyor-General; and
(b) in the case of an application made by… the owners of Māori land, the Registrar of the Māori Land Court; and
(c) in any other case, the Registrar-General of Land.

Legislation Extract from BA04:
S73(2) requires a copy of the [PIM] that has been issued in relation to the building consent in question, and s73(3) requires identification of the natural hazard concerned. S74 requires that records are kept by those receiving notifications under s73, and s74(1)(b) requires an entry on the record of title to the land on which the [relevant] building work is carried out.

Section 74(3) and (4) provides for the BCA to be able to notify the relevant party of any entry that is no longer required, and for their records to be updated and for the entry to be removed from the record of title.

Sections 71-74 BA04 shift much (but not all) of the long-term liability away from the TA and onto the landowner. The TA still needs to hold robust and defensible natural hazard data, undertake assessments using competent people, and keep records of all decisions made (ie duty of care) to reduce long-term liability.

6.6.6 RESPONSE OF APPLICANTS

Faced with a process that either declines a consent, or grants consent with a s72 entry on the certificate of title, the landowner must decide whether they are willing to take the risk. In my experience applicants will often choose to withdraw the application rather than have it on record that a consent was declined under s71 BA04. The risks of implementing such as consent could include:

- Inability to raise a mortgage for the building works;
- Inability to insure the building works, or higher insurance premiums;
- Unattractiveness to potential future buyers who are risk-averse;
- Reduced property value relative to the risk of future damage, loss, or liability.

This process can create tension, particularly if applicants are not aware of the implications of attempting to undertake building works in a natural hazard area. Tensions are further increased if an applicant has already spent money on plans and lodging a consent. To avoid these situations, it is imperative to provide clear public information, use PIMs, and a pre-lodgement checklist that requires natural hazard assessments done by competent professionals.

6.7 NZ BUILDING CODE CLAUSE E1 SURFACE WATER

NZBC contains mandatory provisions for building work, which comprises the First Schedule to the Building Regulations 1992. Provisions set out the objectives, functional requirements, and performance relative to each Clause.

In reading this part, keep in mind the following NZBC (MBIE, 2023) definitions:

- ***Surface water*** means all naturally occurring water, other than sub-surface water, which results from rainfall on the site or water flowing onto the site, including that flowing from a *drain*, stream, river, lake or sea.
- ***Secondary flow path*** means the path over which *surface water* will follow if the drainage system becomes overloaded or inoperative.
- ***Outfall*** means that part of the disposal system receiving *surface water* or *foul water* from the drainage system. For *foul water*, the *outfall* may include a *foul water sewer* or a septic tank. For *surface water*, the *outfall* may include a natural water course, kerb and channel, or a soakage system.
- ***Other property*** means any land or *buildings* or part thereof which are a) not held under the same allotment, or b) not held under the same ownership, and includes any road.

Extract from NZBC - Objectives:
Clause E1 Surface Water has two objectives which are to (a) safeguard people from injury or illness, and *other property* from damage, caused by *surface water*, and (b) protect the *outfalls* of drainage systems. The functional requirement is that *buildings* and *sitework* shall be constructed in a way that protects people and *other property* from the adverse effects of *surface water*.

Extract from NZBC - Performance:
The first performance requirement E1.3.1 provides for more stringent rules to be set through the RMA91 for the protection of *other property* (see below). In the absence of those the requirement is that *surface water* resulting from an event having a 10% probability of occurring annually and which is collected or concentrated by *buildings* and *sitework*, shall be disposed of in a way that avoids the likelihood of damage or nuisance to *other property*.

The second performance requirement E1.3.2 is that *surface water* resulting from an event having a 2% probability of occurring annually, shall not enter *buildings* however that is limited in application to housing, communal residential, and communal non-residential buildings.

The third performance requirement E1.3.3 is that drainage systems shall be constructed to (a) convey *surface water* to an appropriate *outfall* using gravity flow where possible, (b) avoid the likelihood of blockages,… (e) avoid the likelihood of damage to any *outfall*, in a manner acceptable to the *NUO*, and (f) avoid the likelihood of damage from superimposed loads or normal ground movements.

The E1.3.2 specification of 2%AEP relates to the 50-year design life of buildings, meaning that the standard is to keep surface water from affecting the building during its design life. The TA/NUO authorisation requirements can include higher specifications advised in the PIM, for example extending protection to the 1%AEP or to commercial buildings.

6.7.1 SCOPE OF VERIFICATION METHOD E1/VM1

Extract from NZBC:
The scope of E1/VM1 (MBIE, 2023) says at para. 1.0.1 that it shall be used only if the TA does not have more accurate data available from sophisticated hydrological modelling of the catchment undertaken as part of its flood management plans. At para. 1.0.2 further limitations are that a) the catchment area does not exceed 100ha, and b) the *surface water* results only from rainfall on the catchment and does not include water from other sources such as inundation from rivers, lakes, or the sea.

Para's 1.0.3 to 1.0.6 outline that the focus is on *surface water* arriving at the *building* site, how to remove *surface water* from the *building* site, and dispose of concentrated or collected water to an appropriate *outfall*. Para. 1.0.6 provides for soak pits in suitable ground conditions, but recognises that there is a link to ground stability that is outside the scope.

Para's 1.0.4 and 1.0.8 outline limitations to sizing drains with free flow at the outlet, and makes no allowance for blockages, and goes on to state that anyone using this method must demonstrate that these conditions do not apply to the *building work*.

Effectively E1/VM1 assumes that there are no natural hazards or watercourses impacting the building work because the s71/s72 tests are separate, and anything else is outside the scope and requires specific design. The verification method effectively requires a network and catchment analysis which is why the NUO information takes precedence.

6.7.2 COMPETENCY TO ASSESS

Extract from NZBC:
Para. 1.0.7 requires a competent person with the correct experience or qualifications to undertake the design process.

It follows that the consent application must also be processed by a competent person. Where the NUO's standards and catchment information apply, the person processing the consent must either be part of the NUO, or be explicitly delegated to work on its behalf. This includes any BCA that sits outside a TA needing to refer the building consent to the NUO for authorisations and verification of the network and catchment analysis.

6.7.3 PRIMARY & SECONDARY FLOWS

Extract from NZBC:
Para. 4.0 of E1/VM1 requires assessment of secondary flow from the upstream catchment, but acknowledges that flooding is not likely if the *surface water* run-off from the catchment above is less than $0.3m^3/s$ unless the site is in a depression capable of ponding water.

The above reference to $0.3m^3/s$ equates to roughly anything less than a 1-hectare catchment upstream of the site not needing an assessment of secondary flow, which is because generally only sheet flow will occur. Use of the words flooding and ponding here are a clear link to the natural hazard of inundation. The $0.3m^3/s$ flow or 1-hectare catchment can also be used as a starting point for overland flowpath assessments to provide consistency.

Importantly, in the absence of natural hazards information being identified in the PIM, E1/VM1 is supposed to provide a backstop to achieve the same outcomes albeit for the 2%AEP rain event. In the absence of NUO catchment information and more stringent NUO requirements (such as use of the 1%AEP event), the rain event to be used for secondary flow calculations is the 2%AEP event as given in NZBC E1.3.2.

7 THE ROADMAP TOWARDS INTEGRATED MANAGEMENT OF NATURAL HAZARDS

To achieve the desired outcomes for New Zealand in providing healthy and safe natural and built environments in a way that reduces the scale of loss and impact from natural hazards requires a bringing together of all these elements in ways that people can more easily understand and implement.

Figure 3 demonstrates the existing legislative framework.

Natural Hazards Legislative Framework

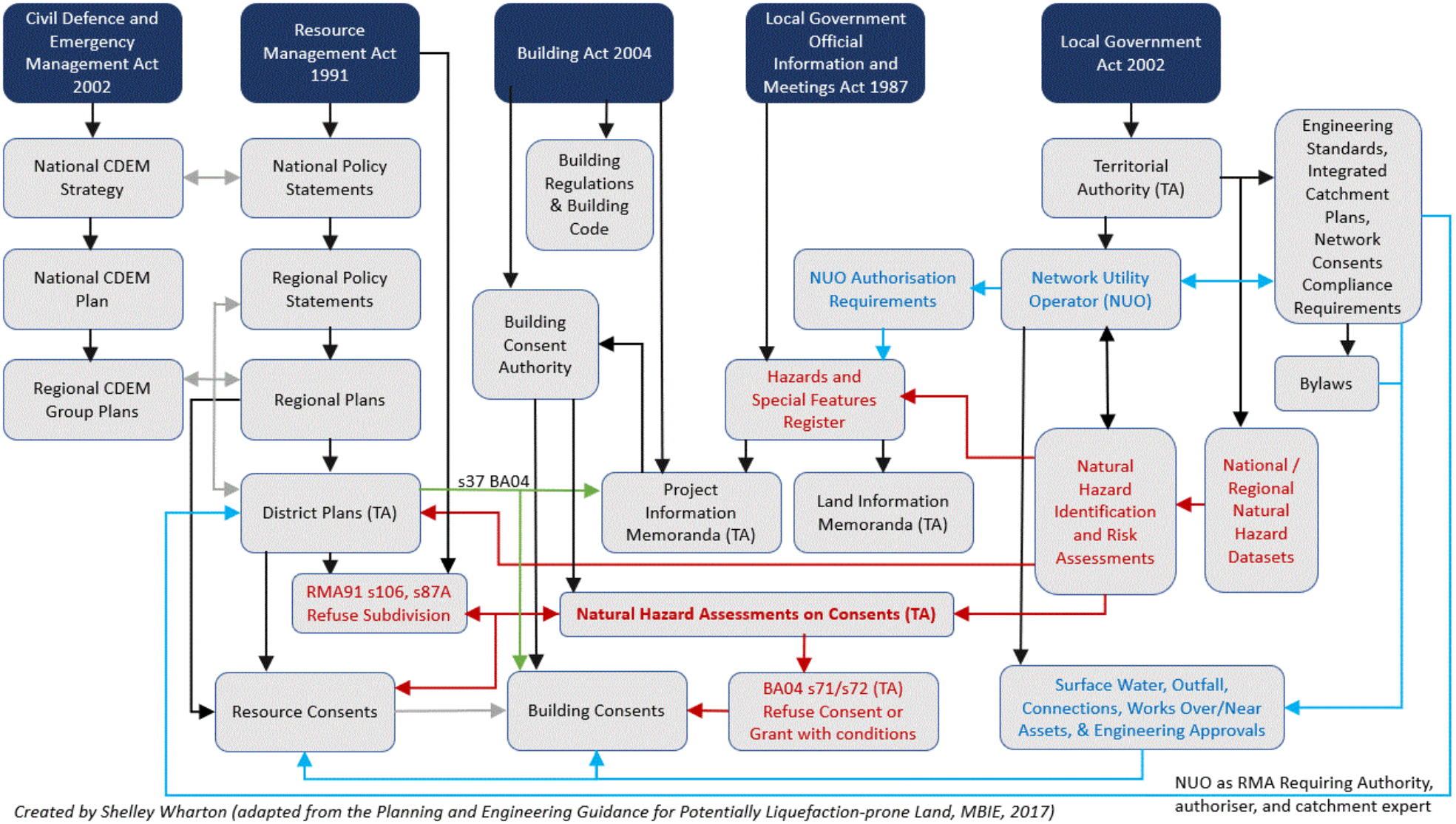


Figure 3 Natural Hazards Legislative Framework

7.1 ROLE OF THE NETWORK UTILITY OPERATOR

NUO's feature across all the legislation in Table 2 above, and form a critical part of the framework shown in Figure 3.

The NUO has a separate role because although they are generally part of the TA and are responsible for stormwater networks (as well as wastewater and water supply), in some cases it is a Council Controlled Organisation (CCO) that is the NUO. Other organisations outside of local government can also be NUO's, however cannot fulfil the functions in Figure 3 because they are not a TA.

Within a TA, the NUO operates under separate official delegations than those of Resource Consents or Building Consents departments. Some of the NUO's additional powers and authorisation requirements include that they:

- are a Requiring Authority under the RMA;
- have engineering standards and catchment plans that override NZBC Clause E1;
- are an authoriser of all outfalls under NZBC Clause E1 (linked to land stability);
- operate under regional discharge consents that have compliance requirements which may need to be passed on to private property owners;
- have authorisation requirements that are contained in LIMs and PIMs;
- have to meet public health requirements under the Public Health Act 1956;
- have to meet environmental performance standards set under other legislation;
- can use regulation to protect assets;
- can set out Bylaws for approval of the TA;
- can use the Public Works Act 1981 (as can a local authority) to implement projects for public benefit, including those to 'Remedy' or 'Mitigate' natural hazards through catchment-scale or nature-based solutions; and
- have key roles in natural hazard management, lifelines, and civil defense.

Engineering or Land Development Standards contain the NUO's design specifications, for example, geotechnical, earthworks and land stability matters, acceptable outfall locations and designs, local rainfall intensities including climate change predictions, primary network sizing (eg 10%AEP pipe systems), secondary network sizing (eg 1% AEP for natural hazards and flows exceeding the primary network capacity), and can specify building floor level requirements beyond the NZBC minimums to manage risks across the TA's area.

The NUO (as part of the TA) can set out Bylaws with the regulation necessary to discharge its legislative functions. This can include a requirement for applications, assessments, and approvals before certain works are done on or near its assets. It can also include conditions regarding compliance on an ongoing basis.

There is a tendency within some RMA and Building teams to disregard or alter the NUO's requirements, sometimes to the point they are unworkable at a catchment scale. NUO authorisations and requirements given under delegation cannot be overridden by RMA or Building Control staff, nor are they the subject of appeal. NUO provisions should give clear statutory powers to implement integrated catchment management plans (ICMP's).

Through ICMP's that include land use and natural hazards, the NUO are well placed as part of the TA to deliver on, as required by RMA91, integrated management of land use and to control the effects for the avoidance or mitigation of natural hazards.

Integrated management requires that many professionals are brought together such as the hazard specialist, stormwater engineer, catchment hydrologist, geotechnical engineer, hydrogeologist, transport engineer, modellers, urban designer, planner, and more. Each brings their own lens and priorities, so must work under a common purpose, set of objectives, and outputs that everyone works towards together.

7.2 NATURAL HAZARD ASSESSMENTS

For local authorities to effectively discharge their responsibilities under the LGA02, RMA91, BA04, and NZBC an extensive list of information needs to be gathered, analysed, interpreted, recorded, and made available to the public in understandable ways. Table 3 provides an example of the natural hazard assessments for land stability and surface water.

Natural Hazard	Competency	Assessment Required
Landslip, Subsidence, Liquefaction, Alluvion, Sedimentation, Erosion (including coastal, bank, sheet erosion)	Combined competency of Geotechnical Engineer, Hydrogeologist, Stormwater Engineer, Catchment Hydrologist, Coastal Processes Expert	Combined geotechnical conditions and stability predictions, with network and hydrological assessments considering erosion, sedimentation, alluvion, liquefaction and overall land stability. Include current and future predictions as a result of development and imperviousness changing surface water flows, concentrating flows, increasing runoff volumes, reducing infiltration, adding outfall locations, and on-site disposal. Include cumulative effects.
Inundation (including flooding, overland flow, storm surge, tidal effects, and ponding) Avulsion (meaning sudden cutting off of land by flood, currents, or change in course of a body of water)	Combined competency of Stormwater Engineer, Catchment Hydrologist, Coastal Processes Expert	Hydrological modelling of surface water for catchments with 100 year ARI over 0.3m^3/s (~1 hectare): • 2 year ARI frequent concentrated flows (ie not sheet flow) • 10 year ARI primary networks • 50 year ARI secondary overland flows • 100 year ARI secondary overland flows and floodplains of streams/rivers • 100 year ARI ponding areas Use rainfall intensity at a regional or local scale and to accommodate future predictions including storm surge, tidal effects, and sea level rise as it impacts flooding levels in lower catchments. Use LIDAR and/or on-site survey depending on accuracy needed.
Esplanade reserve requirement, determination of river bed width in relation to esplanade function in natural hazard management	Stormwater Engineer, Catchment Hydrologist	Undertake hydrological modelling to determine the extent of the *mean annual flood (MAF)* of average recurrence interval ARI 2.3 years (*Stumbles et al, 2008*) to identify those waterways with an average river bed width of 3.0 metres or greater. Map the MAF extent and set the total esplanade reserve width from the stream to 20 metres beyond the MAF in the District Plan.

Table 3: Example Natural Hazards Assessment - Land Stability and Surface Water

The information included in Table 3 is necessary to enable the land and water hazards to be assessed as defined in the legislation and avoid legal loopholes. Local conditions will need to be factored into decisions on the specific assessments needed.

Technical information has limitations as to assumptions, inputs, and uses which need to be clearly documented. Natural hazard maps are sometimes an indicator that more in-depth on-site analysis and verification needs to be done, which can be a reason for resistance to firm rules in District Plans. Clear parameters can reduce this resistance.

7.3 COMMUNICATION OF NATURAL HAZARDS

Interpretation and communication about how and when to use natural hazard data is often over-simplified. This is a response to a complex environment that is largely under-resourced, with high costs, and high stakes.

Geotechnical engineers, stormwater engineers, and catchment hydrologists are often immersed in the technical world of research, calculations, statistics, modelling, risks, and hard infrastructure. With such a complex focus, the opportunity to communicate results in ways that the public can easily understand can be missed.

Better communication of natural hazards and risks would assist local authorities to discharge their duties under the various legislation and reduce negative public responses. However, the complexity of the legislation, use of different terminology within the various Acts, and the number of experts needed makes this an almost impossible task.

Developers and their lawyers are quick to exploit any gaps or put pressure on the system due to the high risk and high reward nature of their business.

Explaining the consequences of long-term liability that are shifted from the local authority to the developer or their future clients through the available legal mechanisms often leads to easier acceptance of the requirements.

7.3.1 TERMINOLOGY

Using terminology that is widely understood by the non-technical general public needs to be front of mind in the communication of natural hazards and risks. Simplifying the natural hazards would help.

Specific wording must be used that correlates the natural hazard definitions under the relevant legislation to the hazard assessment being done. Technical experts need to explain how their assessment encompasses (or not) the full variety of relevant hazards as shown in Table 3 above.

Statistical terms like 1% AEP and 100-year ARI event are often misrepresented and simplified, such as the common reference in media stories to a 1 in 100-year event. Although not interchangeable they are somewhat similar in overall results.

Thinking in terms of something happening once in every *x* years is much more accessible to the general public. Communication and gaining common public understanding would be much simpler if ARI were to be used as a basis for analysis to enable the existing more commonly understood terminology to prevail.

7.3.2 ALIGNMENT TO RMA EFFECTS-BASED PLANNING

The RMA91, which contains the widest definition of natural hazards, has a hierarchy of 'Avoid – Remedy – Mitigate' in relation to environmental effects.

The 'Avoid – Remedy – Mitigate' hierarchy is used to set objectives, policy, rules, and assessment criteria in a regional or district plan. This is a critical interpretation for engineers to get right for natural hazard management and a suggested interpretation is as follows:

> **Avoid** – Identify those areas where locating people and buildings would certainly result in damage or loss, and there is no possibility to remedy or mitigate the risks on site, upstream, downstream, or on *other property*. Also identify where, cumulatively, the effects cannot be safely managed. People should not be able to apply for consent for certain activities in these areas.
>
> **Remedy** – Identify those areas where there is potential to undertake works to remedy the hazard and risk; either at a single site, multi-site, or catchment scale; and identify what the residual risk would be. If the remedy is a multi-site or catchment scale project, identify a trigger for when the hazard would be remedied to the point that the hazard is reduced or removed and land can be rezoned or consents can be applied for.
>
> **Mitigate** – Identify those areas where it may be possible to mitigate the effects on an individual site scale, and/or on an individual cumulative basis across a catchment, to adequately manage the risks. Specify the type of mitigation required, the performance standard, and any ongoing compliance required to maintain the approved state of mitigation.

RMA91 also requires assessments of actual, potential, and cumulative environmental effects. A suggested interpretation for natural hazard management is as follows:

> **Actual effects** – Those effects already occurring or known to occur through cause and effect.
>
> **Potential effects** – Those effects likely to occur to the extent predicted based on knowledge, experience, and analysis.
>
> **Cumulative effects** – Those effects that would actually or potentially arise if too much of a certain thing was done, akin to exceeding the tipping point. Cumulative effects need clear limits of cause and effect. It is the combination of all the residual effects post-mitigation on a catchment scale that cannot be further mitigated.

An example of cumulative effects is that imperviousness of *x*% across the catchment can be mitigated to acceptable levels, but imperviousness of *y*% would increase flood levels downstream to the point that they increase the hazard on other property to dangerous levels that cannot be remedied or mitigated. Another example is where too many stormwater outfalls using on-site disposal methods would cause land instability.

Long-term liability again plays a part because it is those downstream property owners who become adversely affected that will seek action to fix the problem, or compensation, (rightly or wrongly) from the TA.

Using the RMA language when communicating the results of natural hazard modelling and analysis to resource planners and policymakers for the purposes of preparing regional or district plans is essential. Communicating to developers and their consultants in a similar way would provide consistency and less surprises.

7.3.3 TURNING STATISTICAL ANALYSIS INTO RISK-BASED MANAGEMENT

The Proposed NPS-NHD directs a risk-based approach to natural hazards (MfE, 2023). The language used for risk-based assessments needs to be in alignment with RMA91 and the Proposed NPS-NHD. Risks are also more easily understood by the general public.

Table 4 shows an example of what risk-based management could look like. This would need to be carried out for each natural hazard in the context of the development type, hazard severity, the risk to people and property, legislative constraints, and the residual long-term liability in social and financial terms.

Example: Risk-Based Natural Hazard Management - Residential Development				
Risk Profile	**Zone**	**RMA91**	**BA04**	**Natural Hazard Inundation (Flooding)**
Significant risk (Intolerable)	Red	Avoid, Prohibited activity, s106 refuse subdivision	S71 Refuse building consent	10 year ARI event
High risk (Intolerable)	Red	Avoid, Prohibited or Non-complying activity	S71 Refuse building consent	50 year ARI event (2% AEP event)
Moderate risk (more than low risk but not intolerable)	Orange	Remedy or Mitigate, Discretionary activity	S71 refuse BC or s72 grant BC for siteworks only in hazard area (not a building)	100 year ARI (high velocity, large debris load, depth >200mm), potential impact to other property
Low risk (generally acceptable risk)	Yellow	Allow, Restricted Discretionary or Controlled activity	Likely S72 grant BC for siteworks only in hazard area (not a building)	100 year ARI (low velocity, minimal debris load, depth <200mm), no impact to other property

Table 4: Example Risk-Based Approach to Natural Hazards

The purpose of Table 4 is to prompt critical thinking and discussion and to demonstrate risk language in NPS-NHD alongside well-understood 'Red Zone' language and the RMA hierarchy, while considering how technical assessments could relate to it. It is imperative that consideration is given to whether a building consent could be issued in these circumstances (refer BA04 s71-74) to avoid the creation of long-term liability.

An assessment for, say, infrastructure development in those zones would look very different to Table 4 due to the different risk profile. Infrastructure that serves wider communities and provides lifelines requires additional consideration in the category of significant risk for public health reasons, due to the number of people impacted, and higher financial impacts as covered in 6.3 above.

8 CONCLUSIONS

The current natural hazards framework contains many of the elements necessary to effectively manage natural hazards, however these are generally not well understood or implemented.

Simplification of the current system is necessary for consistency and to gain efficiencies at national and local scales. It would time and money in hazard assessments, planning and consenting regimes, communications, and give more certainty for housing developers.

Priority must be given to addressing the systemic issues in natural hazard management. Actions taken now in the legislative and policy space can take 10-plus years to implement and see results within new development consents.

The potential quantum of liability from existing and new developments in high risk natural hazard areas needs to be better understood and communicated to increase social license for change. Without change, the total liability for New Zealand will only increase.

8.1 LEGISLATION

The suite of legislation administered by four government agencies is complex and interconnected. Consideration should be given to consolidation to ensure there is clear focus on natural hazard outcomes.

Simplify the natural hazards definitions and risk definitions across the legislation to help close gaps in implementation and avoid legal challenges on consents.

The NPS:NHD is limited to the RMA framework, so work is still needed on the other legislation. Consider creating a mandatory rather than soft hazard management regime so that it is decoupled to an appropriate extent from the public consultation and appeals processes under the RMA.

PIMs should be a mandatory input to the building design process, potentially linked to the Licenced Building Practitioners regime and design statements.

8.2 POLICY & GUIDANCE

Good work has been happening with national policy on natural hazards, which needs to continue. The inclusion of nature-based solutions and comprehensive area-wide solutions for risk reduction is positive and strongly supported.

National direction is desperately needed. The creation of a standard approach to identify hazards and undertake risk-based assessments should be prioritised.

Clarify roles and remove overlaps between national, regional, and local responsibilities in hazard management. Investigate strengthening NUO provisions under RMA91 for natural hazard management. Give explicit statutory powers to implement engineering standards and integrated catchment management plans.

Enable prohibited development rules in Intolerable Risk areas. Firm rules about hazard management would increase certainty around developable and non-developable areas, and therefore reduce conflict, timeframes, and costs to developers and homeowners.

Make mandatory the sharing of relevant hazard event information, for example from the insurance industry, emergency services, and other agencies to enable local government to continually improve records with verifiable hazard information.

8.3 RESOURCING

Capability and resourcing constraints across many local government organisations needs to be addressed. CDEM Regional Groups may be able to communicate the pressing need for resourcing, however relying on the decision-making of multiple local authorities for consistent resourcing at a regional scale needs to be addressed.

Require adequate resourcing of natural hazard planning and management work to reduce the long-term liability nationwide.

8.4 IMPLEMENTATION WITHIN EXISTING HAZARD FRAMEWORK

Implementation across so many interconnected components has issues. Focus on the easiest and best control points first. Not all control points in the framework require a public consultation process or a regional/district plan change, they can simply be implemented.

Use the Special Features provisions of LGOIMA87 to better effect in natural hazard management, including authorisation requirements for outfalls as a critical part of stormwater management and land stability. Inclusion of each natural hazard as a Special Feature opens the door, through the PIM to S71 BA04, and to s106 RMA91, to refuse development in natural hazard areas where it would have unacceptable impacts.

Rely more heavily on NUO's by using Engineering or Land Development Standards and associated network approval processes, Bylaws, and inputs to LIM's and PIM's.

Simplify compliance processes for enduring natural hazard management.

Use available legal mechanisms to transfer long-term liability to the property owner through subdivision consent notices, easements, and other notices on the certificate of title. At the time of property sale, lawyers will explain to any prospective purchaser the meaning and implications of these notices. In this way they become aware of their ongoing responsibilities before buying.

8.5 WORKING TOGETHER

Due to the integral connection between surface water and land stability, the onus is on the stormwater and geotechnical professionals collectively to improve the approach to integrated management of natural hazards.

Work together and share information effectively across the many different organisations, professions, and authorisers involved to minimise the current system's gaps and vulnerabilities to failure.

A cohesive multi-disciplinary approach based on common purpose, objectives, and outputs is required to improve the assessments made for TA's hazard registers, District Plans, resource consents, and building consents.

8.6 COMMUNICATING HAZARD RISK

Communication to gain common public understanding of water-related hazards would be simpler if ARI was used as the basis for hydrological analysis. ARI translates better into the more commonly understood terminology of an event happening, say once in 100 years.

Use RMA language to communicate the results of natural hazard modelling and analysis to resource planners for the purposes of preparing regional or district plans.

It is essential to communicate with the public using information that is consistent, relatable and easily understandable. Communicate the process and risks early to reduce friction with

consent applicants. Use pre-lodgement checklists for consents to ensure natural hazards are properly considered and assessed prior to lodgement.

8.7 OUTCOMES FOR AOTEAROA NEW ZEALAND

Local authorities and landowners must be enabled to understand their individual and collective responsibilities so they can do their part to keep the whole system functioning to minimise risks, increase resilience, and to keep people and communities safe and healthy into the future.

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