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Incorporating social vulnerability into land use planning and local government processes for managing natural hazards and climate change in New Zealand

Prepared for the Centre for Public Health Research

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Contents

Tables

Figures

Executive Summary

This report has been prepared to support research currently being undertaken by the Centre for Public Health Research, which has developed indicators for the social vulnerability of populations to natural hazards in New Zealand, using the case study of flooding in Porirua City. This report specifically considers how social vulnerability can be better incorporated into the land use planning and civil defence functions of local government. It finds that the three key pieces of legislation to facilitate this are the Civil Defence Emergency Management Act 2002, Resource Management Act 1991 and Local Government Act 2002. While none of these statutes specifically include the term vulnerability, they provide a number of pathways to enable greater inclusion of social vulnerability and resilience into local government policies, plans and processes.

Firstly, the report considers how social vulnerability can be incorporated into land use planning under the Resource Management Act 1991. Traditionally, consideration of social vulnerability has not explicitly been included in local government land use plans (e.g. Regional Policy Statements, Regional Plans and District Plans) prepared under this Act. This report suggests an adaption to the consequence table developed by Saunders et al., (2013) as part of the risk-based approach to land use planning, as a potential way that vulnerable activities can be considered. To be able to incorporate vulnerable activities into land use plans, it was determined that the measurement of what constitutes a vulnerable activity needed to be limited to point source activities for the purposes of simplicity and measurability. This means social factors such as employment of an individual, marital or family status, migrancy status etc. do not form the basis of the vulnerability assessment, but rather the sensitivity of the activity to the impacts of natural hazards does.

As a prerequisite, vulnerable activities needed to be defined. For the purposes of land use planning and the requirement for these to be based on point source locations or activities, a potential definition for vulnerable activities for land use planning was proposed, as follows:

Vulnerable activities are defined as buildings that accommodate any of the following activities:

- Assisted living facilities;
- Schools and early childhood education centres (ECE);
- Hospices;
- Marae;
- Medical and health service facilities;
- Mental health facilities;
- Pharmacies;
- Retirement villages/aged care facilities;
- Respite care or rehabilitation facilities; and

- Social housing or residential units constructed by social housing providers.

The second step was to populate the consequence table with a new column. As the definition of vulnerable activities is based upon activities within structures, and for the purposes of consistency across the table, the metric of percentage of buildings whose functionality is affected was the most appropriate to use. It was also considered appropriate that the consequence table thresholds defined for social and cultural buildings and critical buildings were applied to the new vulnerable activities column.

The report also includes a case study from the proposed Porirua District Plan, to demonstrate an alternative method of using land use planning under the Resource Management Act 1991 to recognise and address social vulnerability. In this example, vulnerability is addressed by controlling the location of activities that accommodate vulnerable people, such as aged care facilities, schools, and early childhood education, to avoid an increase in risk to those who are least resilient to the effects of natural hazards.

Secondly, social vulnerability indicators have the potential to inform actions during all four phases of civil defence and emergency management, being readiness, response, recovery and risk reduction, but particularly in the readiness and response phases. A number of possible applications for the indicators are highlighted in this report.

Finally, a number of plans and strategies are prepared by councils under Local Government Act 2002 to guide the long-term development of communities, and the incorporation of social vulnerability indicators could ensure that the needs of the vulnerable are recognised and strategies are implemented to increase resilience. Importantly, the purpose of this Act includes the enablement of democratic local decision-making that meets the current and future needs of communities. However, too often the underprivileged do not have adequate access to political power. Therefore, this report concludes by providing recommendations to support vulnerable people and the groups representing them in the decision-making process.

1. Introduction

Natural disasters experienced around the world continue to highlight that certain groups within society are more vulnerable to the impacts of disasters than others. Social factors such as low income, lack of insurance and poor housing quality are known to increase the impact of natural hazards on people that live with these conditions, and make their recovery more difficult (Chang et al., 2015). Vulnerability of populations is also linked to exposure, for example development that is located on a floodplain or in a coastal zone, as well as susceptibility to natural hazards, such as those that are young, elderly or suffer physical or mental health problems.

Land use planning has a key role to play in reducing exposure and susceptibility to hazards by managing the location and design of activities, for example by avoiding development on hazard prone land or setting minimum floor levels to mitigate the risk of flooding. In this way land use planning can contribute to reducing the vulnerability and improving the resilience of the wider community. Social vulnerability indicators have the ability to support the management of natural hazard risk and the effects of climate change by providing an evidence base upon which to rely when making land use planning decisions. Social vulnerability indicators can also assist in emergency management, by enabling the targeting and prioritising of preparedness initiatives and emergency response and recovery efforts.

Yet while the use of quantitative indices to assess the vulnerability of different communities to disasters is well established in research and practice (Chang et al., 2015), their application in local government[1] processes in New Zealand is limited. Therefore, the focus of this study is to consider potential pathways to incorporate social vulnerability indicators into civil defence emergency management and land use planning at a local government level in New Zealand, with the aim of making vulnerable communities more resilient to the impacts of natural hazards and climate change.

1.1 Outline of the Report

Section 2 provides the wider context of the report and discusses the development of social vulnerability indicators for Porirua by Mason et al., (unpub), while exploring the concepts of exposure, susceptibility, vulnerability and resilience. The importance of recovery planning for reducing vulnerability is also discussed, particularly in the context of housing.

The legislative framework under which natural hazards are managed in New Zealand is provided in Section 3, including the influence of New Zealand's global agreements, such as to the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework).

Section 4 considers how to incorporate social vulnerability indicators into local government processes under the legislative framework identified in Section 3. This includes exploring how the risk-based approach to land use planning under the Resource Management Act 1991 (RMA) can be adapted to include consideration of social vulnerability. Two options are presented; the first which amends the consequence table to create an additional 'Vulnerable Activities' column, and the second which is a case study of the proposed Porirua District Plan

[1] Local government in New Zealand consists of regional, city and district councils, as well as unitary authorities that have the functions of both a regional and district/city council.

framework for managing natural hazards which determines consequences based solely upon the sensitivity of activities and the likelihood of an event occurring. This enables the consideration of social vulnerabilities, by providing a point source of certain activities (e.g. social housing) that can be managed under the RMA. In conjunction with the wider incorporation of concepts of resilience and sustainability across all local government functions this approach can promote the health and wellbeing of socially vulnerable groups.

To support increased involvement of vulnerable people and the groups that represent them in local government processes, Section 5 provides guidance on how to write and present a submission to better ensure the voices of vulnerable people are being heard. Concluding comments are provided in Section 6.

2. Social Vulnerability to Flood Hazards

2.1 Development of Social Vulnerability Indicators

In order to better understand social vulnerability to flooding in Porirua City, Wellington, Mason et al., (unpub) developed a conceptual framework where social vulnerability is comprised of three main components (Figure 2.1):

- Exposure (being exposed to the hazard);
- Susceptibility (being more susceptible or sensitive to the impacts of the hazard due to age, health status, disability); and
- Lack of resilience (determined by the capacity to anticipate a shock, cope and recover).

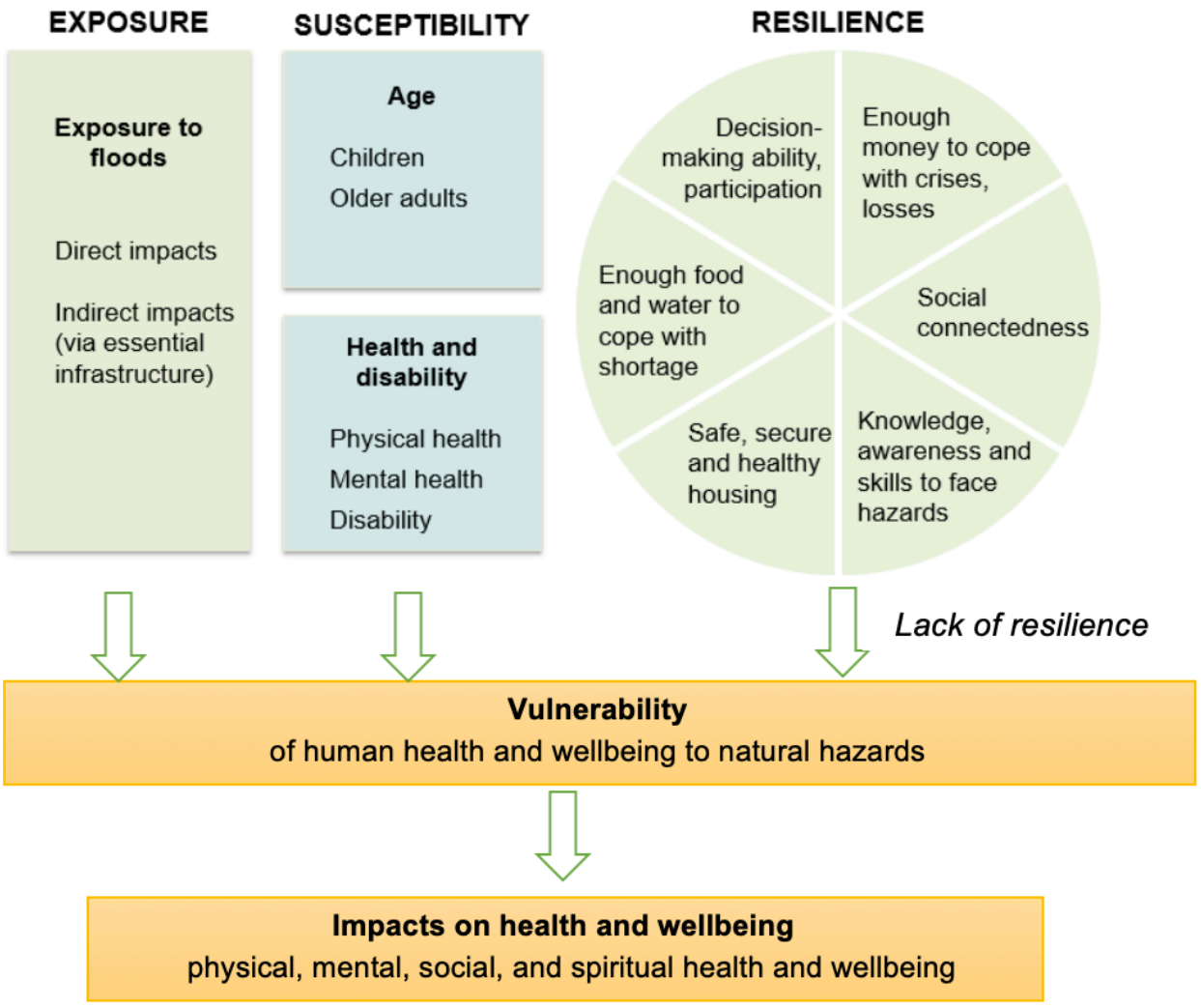

Figure 2.1: Conceptual framework for social vulnerability to natural hazards in New Zealand (Mason et al. unpub).

Exposure is related the location of people and activities and can be either direct, for example development being located on a floodplain, or indirect, such as potential isolation due to transport routes being affected.

From a social perspective, susceptibility refers to the potential for increased exposure to a hazard due to factors such as age, disability, or health, which impact upon a person's ability to evacuate or recover from the social impacts of natural hazard events. For example, children and aged persons are more susceptible to infections and disease in the aftermath of a disaster event, and mental health issues may be exacerbated by increased stress (Mason et al., unpub).

Resilience is defined by the United Nations Office for Disaster Risk Reduction (UNISDR) as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions." (United Nations, 2015, p. 9). Having strong social connections (social capital) makes people more resilient during and after a natural hazard (Vallance, 2011), and this is where cultural centres such as churches and marae can play an important role in reducing the societal impacts of events.

In the framework presented in Figure 2.1 vulnerability is a consequence of these three factors, and can be thought of as "the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impacts of hazards" (United Nations, 2015, p. 10). For example, if a severe flood impacts an affluent area where there are high levels of home ownership and insurance, while the economic costs from the event will be high, the social implications are lessened as people are able to rebuild, return and 'bounce back' faster. In comparison, if a less severe flood occurs in a lower socio-economic area with a high proportion of social housing, the social cost is potentially much higher, due to a lack of financial resources and ultimately control over individual recovery.

If social vulnerability is to be reduced, all components (exposure, susceptibility and resilience) need to be addressed, while recognising that they are not static and will vary across temporal and spatial scales (Cardona et al., 2012). This report considers how emergency management and land use planning can address those circumstances where social conditions result in individuals and groups of people being more likely to be affected by a natural hazard event, and less able to cope or adapt. Based on the framework presented in Figure 2.1, indicators have been identified to measure each dimension. The indicators can be used across the 4Rs of emergency management to reduce vulnerability to not only flooding, but all natural hazards. They also have the ability to inform local government plans, policies and actions, as explored below in Section 4.

2.2 Recovery Planning

Planning for recovery before an event occurs allows for the identification of those areas at risk from natural hazards and plan how to best manage them to reduce risk, including options for redevelopment after a disaster occurs (Becker et al., 2008). This is discussed further below in terms of housing recovery, as housing stability after a disaster event is a key factor in expediting the recovery process while promoting the health and well-being of individuals. Therefore, recovery planning at the local government level has an important role to play, as it provides a pathway to reduce the social vulnerability of both current and future communities.

2.2.1 Housing Recovery

Access to adequate shelter is critical to the health, well-being and economic stability of individuals. Our homes provide us with security and familiarity that can be vital to our individual and collective resilience following a major event (Wellington City Council, 2017). This is particularly important in the context of social vulnerability, as those that live in social housing or rental accommodation generally will have less access to financial resources and therefore less control over their recovery. Experience has shown that people and communities that are displaced after a natural disaster take longer to recover and suffer more adverse effects (Community and Public Health, 2011). In addition, Quarantelli (1982) note that the more times disaster victims are moved in the temporary shelter and temporary housing phases, the longer recovery takes, as the ability to adapt and cope with changing circumstances decreases. Therefore, a comprehensive recovery plan that includes policies and procedures to facilitate the temporary sheltering and housing of people as close to their homes as possible in the period following a disaster is essential to supporting the health and wellbeing of those affected and preserving important social and economic networks.

Marae have proven to be a vital resource in New Zealand for providing emergency and temporary housing for displaced people, such as in the aftermath of the 2004 Manawatu floods (Hudson & Hughes, 2007), 2010/2011 Canterbury earthquakes (Thornley et al., 2015), 2016 Kaikoura earthquake[2] and the 2017 Edgecumbe stopbank breach[3]. In recognition of this, and the key role that marae have played in strengthening the resilience of communities, the Labour government announced in 2019 that $12 million dollars is to be spent on increasing the emergency preparedness of marae throughout the country[4].

[2] See: https://www.rnz.co.nz/news/national/318520/%27we%27re-here-to-help,-we%27ll-help-anybody%27
[3] See: https://www.rnz.co.nz/news/national/355678/marae-initiative-to-help-edgecumbe-residents-without-homes
[4] See: https://www.stuff.co.nz/national/politics/113998580/12m-to-make-marae-disasterready

3. Legislative Context

Natural hazards are managed in New Zealand under a number of statutes. The three primary pieces of legislation considered most relevant to the inclusion of social vulnerability data in local government processes are the Civil Defence Emergency Management Act 2002 (CDEM Act), the RMA, and the Local Government Act 2002 (LGA).

The Building Act also provides mechanisms for the reduction of natural hazard risk and therefore is included in the following discussion, however its scope in terms of promoting social resilience is limited. This is because the Building Code regulations created under this Act are set at a national level, and there is little or no opportunity at a local government level for councils to change their Building Act processes to better recognise vulnerable activities. The same applies to the Local Government Official Information and Meetings Act 1987 (LGOIMA), which is also included below, as the key piece of legislation relation to the open access of information to the general public.

Since 2015, the legislative framework for managing natural hazards in New Zealand has become increasingly influenced by the Government's commitment to three main global agreements, being the Sendai Framework, the Paris Agreement on Climate Change and the 2030 Agenda for Sustainable Development under which the Sustainable Development Goals (SDGs) are identified. The Sendai Framework in particular seeks to shift the focus from managing natural disasters to managing risk and strengthening the resilience of people and communities, which is supported by four priorities for action:

1. Improving the understanding of disaster risk;
2. Strengthening disaster risk governance at all levels;
3. Promoting public and private investment in disaster risk reduction to enhance resilience; and
4. Strengthening of disaster preparedness, and the need to 'build back better'.

(United Nations, 2015).

The Climate Change Response (Zero Carbon) Amendment Bill has been introduced to help New Zealand reduce carbon emissions in line with the Paris Agreement. This proposes to establish a Climate Change Commission that will assess climate related risks, to inform a National Adaptation Plan aimed at increasing resilience to the effects of climate change by providing an integrated nationwide approach to adaptation (Ministry for the Environment, 2019). Therefore, if the amendment bill is passed, the Climate Change Response Act has the potential to become a significant player in reducing the risk posed by those natural hazards whose effects will be intensified by climate change, such as flooding and coastal erosion, and increasing the resilience of affected communities.

3.1 Civil Defence Emergency Management Act 2002

The CDEM Act provides the framework under which natural hazards in New Zealand are to be managed, and sets out the duties, responsibilities and powers of central and local government, lifeline utilities and emergency services. It establishes an 'all-hazards' approach that seeks to achieve the sustainable management of hazard risk through the '4 R's' of reduction, readiness, response and recovery. The CDEM Act, which is administered by the Ministry of Civil Defence and Emergency Management (MCDEM), requires the formation of a number of regional CDEM Groups[5] and each must prepare a CDEM Group Plan that details how the risks that threaten their region will be managed. Amendments in 2016 strengthened the requirement for CDEM Groups to undertake recovery planning, to support communities in the aftermath of a natural hazard event. However, the linkage between CDEM Group Plans and policies and plans prepared under the RMA is generally weak and needs to be strengthened at a legislative level to facilitate improved management of natural hazards and reduction of risk (Saunders et al., 2007).

In April 2019, the National Disaster Resilience Strategy came into effect, replacing the National Civil Defence Emergency Management Strategy. The Resilience Strategy outlines the vision for a resilient New Zealand, and what is going to be done over the next ten years to achieve this goal. The Strategy identifies three main priorities, being:

1. Managing risks;
2. Effective response to and recovery from emergencies; and
3. Enabling, empowering and supporting community resilience.

Each of these priorities is supported by six objectives. While only newly introduced, the Strategy has the potential to provide the basis for an integrated and co-ordinated approach to managing natural hazard risk to improve community resilience and reduce social vulnerability.

3.2 Resource Management Act 1991

3.2.1 Management of Natural Hazards under the RMA

The RMA is the primary legislation under which land use planners in New Zealand manage natural hazards. The purpose of the Act is to promote the sustainable management of natural and physical resources, which is defined in section 5(2) as:

> *…managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—*

[5] CDEM Groups are made up of representatives from territorial authorities, regional council, emergency services and lifeline utilities.

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

As such, the risk from natural hazards needs to be considered when managing use and development under the RMA to enable and provide for the social, economic and cultural well-being of people and communities, as well as their health and safety.

Amendments to the Act in 2017 inserted the management of significant risks from natural hazards as a matter of national importance under section 6(h). Natural hazards are defined as:

> a*ny 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 or may adversely affect human life, property, or other aspects of the environment.*

Section 106(1)(a) specifically provides for consent authorities to decline an application for subdivision consent or grant it subject to conditions if it considers that there is a significant risk from natural hazards. While the term 'significant' is not defined in the RMA, section 106(1A) does provide those matters to consider when assessing if risk is significant, being:

(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).

The RMA also does not define the term risk, however the CDEM Act defines it as the likelihood and consequences of a hazard. Therefore, by requiring consideration of both the likelihood and consequences of natural hazards, section 106 of the RMA implicitly adopts a risk-based approach. Sections 6(h) and 106(1A) signal a shift in land use planning for natural hazards in New Zealand, which has traditionally focused on the likelihood of an event occurring, with little consideration of the scale of potential consequences. The emphasis on planning for the hazard, as opposed to the risk, has often resulted in development of areas prone to natural hazards and an increase in the risk to people and property (Saunders & Kilvington, 2016). A risk-based approach requires decision makers to consider those hazard events with severe consequences but a low likelihood of occurrence, such as tsunami, which have generally been disregarded in district level decisions. While the focus of section 106(1A) is land and structures, section 5 includes enabling the health and safety of people and communities as part of the purpose of the Act, and therefore requires consideration of the social impacts of natural hazards.

Of particular relevance to natural hazards such as flooding, coastal erosion and rainfall induced landslides, is Section 7(i) of the RMA, which identifies that in achieving the sustainable management purpose of the Act, those exercising functions and powers under the RMA shall have particular regard to the effects of climate change.

Regard for the effects of climate change is reinforced in the New Zealand Coastal Policy Statement (NZCPS), which also requires local authorities to avoid development in coastal areas identified as being at risk of coastal hazards, including avoiding the locating of lifeline infrastructure in these areas.

3.2.2 Implementation of the RMA

In terms of avoiding or mitigating the effects of natural hazards, section 30 of the RMA directs that regional councils are responsible for controlling the use of land, while section 31 directs that territorial authorities[6] (TAs) are responsible for controlling the actual or potential effects of the use, development or protection of land. Both regional council and TAs have a duty to collect information on natural hazards under section 35(1).

The RMA is implemented through a hierarchy of planning instruments, with National Policy Statements (NPS) and National Environmental Standards (NES) sitting at the highest level, followed by Regional Policy Statement (RPSs), Regional Plans and finally District Plans (Saunders et al., 2007). Section 60 of the RMA requires that at all times there shall be an RPS for each region of the country, which is prepared by the regional council. An RPS must state the significant resource management issues for the region and objectives, policies, and methods (excluding rules) to implement the policies (section 62(1)). Regional and District Plans must give effect to the RPS.

3.3 Local Government Act 2002

The LGA provides the obligations and powers of local government in New Zealand and the general framework under which they must operate. Section 10 states that the purpose of the LGA is to enable democratic local decision-making that meets the current and future needs of communities in terms of infrastructure, services and regulatory performance in a cost-effective manner. Section 11A(d) directs that in performing its role, local government shall have particular regard to the avoidance and mitigation of natural hazards. It is under the LGA that the Long-Term Plan (LTP) is prepared by local authorities, which must cover a period of at least 10 years and provide for integrated and co-ordinated decision-making. It provides a description of local authority activities, which can include actions to manage the effects of natural hazards and climate change. Also relevant is section 145(b) which gives local authorities powers to make bylaws for the purpose of protecting, promoting or maintaining public health and safety. Bylaws can be a useful tool to facilitate and support post-event recovery processes, for example by allowing public open spaces to be used for temporary accommodation after a major event has occurred. Under section 149, regional councils are given the power to make bylaws for flood protection and flood control works.

[6] Territorial authorities are the second tier of local government in New Zealand, sitting under regional councils. The term is used to include city and district councils, as well as unitary authorities that serve the role of both a city/district council and a regional council.

3.4 Building Act 2004

While the RMA is focused on ensuring that the use of land sufficiently avoids or mitigates the potential effects of natural hazards, the Building Act concerns itself with ensuring that any building constructed is safe and fit for purpose, including consideration of the risks from natural hazards, through compliance with the Building Code regulations.

Section 71 of the Building Act requires that TAs refuse consent for the construction of a building or major alterations on land that is subject to natural hazards where the proposed works will accelerate, worsen or create a hazard on that land or any other property, unless the TA considers adequate mitigation measures are taken to protect the land, building or other property. However, section 72 does allow building consent authorities to grant building consent for land subject to natural hazards with no mitigation when it is determined that the proposed works will not accelerate, worsen or create a hazard, and it is considered reasonable to grant a waiver or modification of the Building Code. In these situations, the property owner takes on the risk which is recorded on the title for the property through procedures under section 73 of the BA.

Section 71(3) defines natural hazard to mean:

(a) Erosion (including coastal erosion, bank erosion and 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); or

(e) Slippage.

The Building Code regulations established under the Building Act set certain performance requirements for new buildings, for example that surface water must not enter houses in a 1 in 50 year (2% AEP) flood event (Clause E1.3.2).

In addition, section 31 provides for the preparation of Project Information Memoranda (PIM) when requested from the local territorial authority. While not compulsory, a PIM will identify any special feature of the land, which includes susceptibility to natural hazards, such as the potential for erosion, slippage, or flooding.

3.5 Local Government Official Information and Meetings Act 1987

The LGOIMA also has a role in managing natural hazard risk, as it is under this piece of legislation that Land Information Memoranda (LIM) reports are requested from TAs. TAs have an obligation under the LGOIMA to include on a LIM any information known about a site that is not provided in the District Plan, including natural hazards. While not required, is considered good practice to include natural hazards information on a LIM even if it is provided in the District Plan (Saunders & Mathieson, 2016). However, LIMs are not mandatory and are generally only requested when a property is available for purchase. Therefore, many property owners may not

be aware of the hazards that their land is subject to. In addition, a high proportion of vulnerable people may live in social housing or rented accommodation, and therefore LIMs have a limited role in reducing the vulnerability of these groups. Regardless, LIMs do provide a tool for reducing exposure to natural hazards as potential purchasers can make an informed decision about the level of risk that they are willing to accept.

4. Incorporating Vulnerability into Local Government Processes

4.1 Introduction

As identified in Section 3, it is considered that the three main statutes that can be used to reduce social vulnerability to natural hazard events at a local government level are the RMA, CDEM Act, and LGA. This section of the report will explore how vulnerable activities are generally recognised by local government under these three Acts, while identifying how this could potentially be improved. With respect to the RMA analysis, two approaches are provided with respect to how to recognises vulnerable activities within land use planning. The first approach is a variation to the risk-based approach prepared by Saunders et al (2013). This approach demonstrates how the consequence table within the risk-based approach can be modified to incorporate vulnerable activities. The second approach is a case study from Porirua City Council who are currently undertaking a review of their District Plan. Porirua City Council have modified the risk-based approach provided by Saunders et al (2013) and they are seeking to recognise vulnerable activities through their land use planning provisions.

This report concentrates on exploring the mechanisms available under the RMA for addressing vulnerable activities, and briefly explores the other legislative mechanisms available to local councils. It is however recognised that a co-ordinated approach will be required across the plans and policies prepared under the various Acts if social vulnerability to natural hazards is to be effectively addressed. No one piece of legislation or one approach will fully address the management of natural hazard risk relative to vulnerable activities.

4.2 Land Use Planning under the RMA

Land use planning is the main mechanism for achieving risk reduction to future development from natural hazards. There are a number of mechanisms available to land use planners, including:

- Restriction of development in areas subject to natural hazards, either by reducing existing risk (e.g. managed retreat), avoiding future development or mitigating the potential effects (e.g. raised floor levels in areas of flood inundation);
- Restricting the location of critical buildings (e.g. hospitals) and vulnerable land uses (e.g. day cares, schools, rest homes) in areas subject to natural hazards;
- Protection of natural flood buffers during the planning process e.g. requiring esplanade strips to protect riparian margins under section229(a)(v) of the RMA;
- Requiring urban design that promotes resilience (e.g. connectivity of routes for evacuation, installation of emergency rainwater tanks, communal open space areas to encourage social connectedness etc.);
- Recovery planning to promote resilience in rebuilding after an event has occurred;
- Ensuring policies facilitate emergency/temporary housing solutions, for example at schools, marae and public places.

The RMA is the primary piece of legislation under which land use planners operate to guide where people live, work and recreate, primarily through zoning of different activities. As previously identified, councils are required to provide for the social wellbeing of communities and the health and safety of people. In respect to natural hazards this is achieved through Section 6(h) of the Act that requires the management of significant natural hazard risk. Historically, natural hazard planning in New Zealand has been disjointed with different council's taking different approaches. There has also often been a one size fits all approach when considering what constitutes a community, and little consideration has been given to the vulnerability of future occupants. As such, activities that contain vulnerable activities (such as childcare centres, rest homes etc.) have been treated in a similar manner to less vulnerable activities (for example retail stores and commercial buildings).

With the recent inclusion of the consideration of significant natural hazard risk, the thinking around vulnerability is slowly changing, and is starting to get further inclusion within natural hazard provisions at regional and district council levels. However, current recognition of vulnerable communities is largely limited to objective and policy identification, with very limited consideration at a rule level.

There are two key RMA documents that are prepared by councils, being RPSs and District Plans. RPSs are prepared by regional councils and set the overarching outcomes sought for a region. This includes outcomes in respect to natural hazards. As previously identified in Section 3, District Plans must give effect to RPSs. This essentially means that District Plans must take the regional outcomes sought and implement them at a local government level. Many RPSs are now directing a risk-based approach to the management of natural hazard risk and there is an opportunity to recognise vulnerable communities within a risk-based planning framework. The following section of the report outlines the current guidance around risk-based planning. We will then consider how this current approach can be adapted to include a consideration of vulnerable activities, before outlining the draft Porirua District Council approach, which represents a step forward in land use planning through the inclusion of vulnerable activities within a land use planning framework.

4.2.1 Risk Based Planning

In recognition of the failures of past planning practice, land use planning in New Zealand has in recent years been moving towards a risk-based approach that considers not only the likelihood of a natural hazard event, but also the potential consequences. This means that decisions are made based on the level of risk posed, rather than whether or not an event is likely to occur. It ensures that events with a low probability but high potential impact, such as large tsunami and earthquakes are considered. It also ensures that the planning response is proportionate to the level of risk posed. For example, in flood inundation areas where the risk to property and life is low, requiring minimum floor levels above a specified flood level may be a suitable response, whereas in areas of fast flowing water where the risk is higher, such as close to stream corridors or overland flow paths, restricting development in these areas might be a more appropriate response (Porirua City Council, 2019).

GNS Science has developed a toolkit that outlines an approach to risk-based planning (Saunders et al., 2013). A full summary of the five steps associated with the risk-based approach is outlined in Appendix A[7]. This toolkit takes a matrix approach to the management of natural hazard risk, where both the consequences of a natural

[7] The toolkit is also available at https://www.gns.cri.nz/Home/RBP/Risk-based-planning/A-toolbox

hazard event and the likelihood of the event are considered. Table 4.1 below outlines the consequence table that was developed as part of the risk-based approach.

Table 4.1: Consequences table for the risk-based approach developed by Saunders et al. (2013).

Severity of Impact	Built				Economic	H&S
	Social/Cultural	Buildings	Critical Buildings	Lifelines		
Catastrophic (V)	≥25% of buildings of social/cultural significance within hazard zone have functionality compromised	≥50% of affected buildings within hazard zone have functionality compromised	≥25% of critical facilities within hazard zone have functionality compromised	Out of service for > 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for > 6 months (affecting <20% of the town/city population)	> 10% of regional GDP	> 101 dead and/or > 1001 injured
Major (IV)	11-24% of buildings of social/cultural significance within hazard zone have functionality compromised	21-49% of affected buildings within hazard zone have functionality compromised	11-24% of buildings within hazard zone have functionality compromised	Out of service for 1 week – 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for 6 weeks to 6 months (affecting <20% of the town/city population)	1-9.99% of regional GDP	11-100 dead and/or 101-1000 injured
Moderate (III)	6-10% of buildings of social/cultural significance within hazard zone have functionality compromised	11-20% of affected buildings within hazard zone have functionality compromised	6-10% of buildings within hazard zone have functionality compromised	Out of service for 1 day to 1week (affecting ≥20% of the town/city population) OR suburbs out of service for 1 week to 6 weeks (affecting <20% of the town/city population)	0.1-0.99% of regional GDP	2-10 dead and/or 11-100 injured
Minor (II)	1-5% of buildings of social/cultural significance within hazard zone have functionality compromised	2-10% of affected buildings within hazard zone have functionality compromised	1-5% of buildings within hazard zone have functionality compromised	Out of service for 2 hours to 1 day (affecting ≥20% of the town/city population) OR suburbs out of service for 1 day to 1 week (affecting <20% of the town/city population)	0.01-0.09% of regional GDP	<= 1 dead and/or 1-10 injured
Insignificant (I)	No buildings of social/cultural significance within hazard zone have functionality compromised	< 1% of affected buildings within hazard zone have functionality compromised	No damage within hazard zone, fully functional	Out of service for up to 2 hours (affecting ≥20% of the town/city population) OR suburbs out of service for 1 day (affecting <20% of the town/city population)	< 0.01% of regional GDP	No dead No injured

The two columns that allow for consideration of vulnerable activities are the Social/Cultural and Critical Buildings columns under Built consequences. Critical buildings are defined by Saunders et al. (2013) as buildings which have a post-disaster function, and include:

- Buildings and facilities designed as essential facilities;
- Buildings and facilities with special post disaster functions;
- Medical emergency or surgical facilities;
- Emergency services facilities such as fire and police stations;
- Designated emergency shelters;
- Designated emergency centres and ancillary facilities; and
- Buildings and facilities containing hazardous materials capable of causing hazardous conditions that extend beyond property boundaries.

Social and cultural buildings are buildings that are of social and cultural importance and include:

- Places of worship;
- Museums;
- Art galleries;
- Marae; and
- Educational facilities.

Using the consequence table in Table 4.1 as a basis, it is possible to modify it so that vulnerable activities are incorporated. This requires the removal of some of the existing activities from the definitions of critical and social and cultural buildings and including them in a new column entitled vulnerable activities. Given this table is intended to be used for land use planning purposes, the measurement of what constitutes a vulnerable activity would need to be limited to point source activities for the purposes of simplicity and measurability. This means social factors such as employment of an individual, marital or family status, migrancy status etc. would not form the basis of the vulnerability assessment, but rather the sensitivity of activities to the effects of natural hazards.

As a prerequisite, vulnerable activities need to be defined. For the purposes of land use planning and the requirement for these to be based on point source locations or activities, a potential definition for vulnerable activities is as follows:

Vulnerable activities are defined as buildings that accommodate any of the following activities:

- Assisted living facilities;
- Schools and early childhood education centres (ECE);
- Hospices;
- Marae;
- Medical and health service facilities;
- Mental health facilities;
- Pharmacies;
- Retirement villages/aged care facilities;
- Respite care or rehabilitation facilities;
- Social housing or residential units constructed by social housing providers.

Note: with the above new definition educational facilities and marae would be removed from the social/cultural buildings definition and medical emergency facilities would be removed from the definition of critical buildings.

The second step is to populate the risk-based table with a new column. The current table has a number of metrics including percentage of building functionality affected, time out of service, economic costs and loss of life. As the definition of vulnerable activities is based upon activities within structures, and for the purposes of consistency across the table, the metric of percentage of buildings whose functionality are affected is considered the most appropriate to adopt.

The current consequence table recognises that the loss of critical buildings and social and cultural buildings can have a disproportionately greater effect than general buildings. As a result, the thresholds for percentage of buildings who functionality are affected is lower than for general buildings. Vulnerable activities by their very nature will take disproportionately longer to recover from a natural hazard event when compared to non-vulnerable activities, and the level of effect on individuals would be greater (as outlined in Mason et al., unpub). On this basis, it is appropriate that the thresholds for vulnerable activities match those associated with social and cultural buildings and critical buildings. The column for the table would therefore be as shown in Table 4.2.

Table 4.2: Proposed column for consequences table to incorporate vulnerable activities.

Severity of Impact	Vulnerable Activities
Catastrophic	≥25% of buildings containing vulnerable activities within the hazard zone have their functionality compromised
Major	11% – 24% of buildings containing vulnerable activities within the hazard zone have their functionality compromised
Moderate	5% – 10% of buildings containing vulnerable activities within the hazard zone have their functionality compromised
Minor	1% – 5% of buildings containing vulnerable activities within the hazard zone have their functionality compromised
Insignificant	No buildings containing vulnerable activities within the hazard zone have their functionality compromised

The above thresholds would mean that as the risk from a natural hazard event increases (being either due to increasing likelihood of an event, or the consequences from the event increasing (or both occurring) (as outlined in Appendix A), a resource consent category would get more restrictive and there would be greater thresholds that a development associated with a vulnerable activity would need to meet to get resource consent approval.

It is acknowledged that this current guidance on risk-based planning has some challenges with regard to implementation, particularly in relation to the level of information required to be collected to determine the

consequence table, and that some of the information needed for the consequence table is fluid and can be expensive to calculate. However, these challenges aside this risk-based toolkit represents the current main piece of non-statutory guidance on this matter and the foundations of the process represent best practice. The addition of a column to accommodate vulnerable activities is feasible and would result in consistent consent levels as the current approach seeks to achieve. The inclusion of this column would also prompt land use planners to actively turn their mind to vulnerable activities, which could lead to a wider recognition of vulnerability within the District Plan.

4.2.2 Porirua City Council Proposed Natural Hazards Chapter

A second example of how the risk-based approach developed by Saunders et al. (2013) can be adapted for integration into a District Plan framework is provided by the case study of Porirua City Council, who is currently undertaking a full review of its District Plan. As part of this District Plan review, the Council proposed a risk-based approach to the management to the following natural hazards:

- Flooding;
- Tsunami;
- Fault Rupture;
- Sea Level Rise; and
- Coastal Erosion.

This risk-based approach used Saunders et al. (2013) as a basis, but modified aspects of the consequence approach to simplify the resulting objective, policies and rule framework and attempt to recognise the differing vulnerability of activities to natural hazards.

The proposed approach took two steps. The first step was to identify activities based on their sensitivity to natural hazards with respect to the potential risk to life, vulnerability of the activity to natural hazard and potential damage to buildings and structure. This step used the Building Importance Category under the Building Code as a starting point to determine whether an activity was a:

- Hazard Sensitive Activity;
- Potentially Hazard Sensitive Activity; or
- Less Hazard Sensitive Activity.

This is based upon the approach that is applied in the Ministry for the Environment's planning guidance for development of land on or close to active faults (Kerr et al., 2003). A planning lens was then applied to the categorisation of buildings to ensure that they aligned with the non-statutory guidance that applies to natural hazards and to ensure that no perverse outcomes would be achieved in terms of risk to life, vulnerability of the activity and property. This assessment resulted in activities such childcare facilities, retirement premises, and

marae being considered as Hazard Sensitive Activities. The proposed categorisation of activities in terms of their sensitivity is provided in Table 4.3.

Table 4.3: Proposed hazard sensitivity classification of land use activities.

Hazard provisions sensitivity classification	Land Use Activities
Hazard Sensitive Activities	• Childcare Centres • Community Facilities • Educational Facilities • Emergency Service Facilities • Hazardous Facilities • Hospital Activities • Marae • Medical and Health Service Activities • Residential Units and Minor Residential Units • Retirement Village Premises • Service Stations • Subdivision that creates a building platform within an identified hazard area for the purpose of accommodating an identified hazard sensitive activity • Visitor Accommodation
Potentially Hazard Sensitive Activities	• Buildings associated with primary production (excluding Residential Units, Minor Residential Units, Residential Activities or buildings identified as Less Hazard Sensitive Activities) • Commercial Activities • Industrial Activities • Retail Activities • Rural Industrial Activities • Buildings associated with Sport and Recreation Activities • Subdivision that creates a building platform within an identified hazard area for the purposes of accommodating an identified potentially hazard sensitive activity
Less Hazard Sensitive Activity	• Accessory buildings used for non-habitable purposes • Buildings associated with primary production (excluding Residential Units, Minor Residential Units, Residential Activities or buildings associated with more than the initial processing of products) • Buildings as defined under Leisure Activities • Buildings associated with marina operations (above MHWS) • Recreational activities

	• Subdivision that creates a building platform within an identified hazard area for the purposes of accommodating an identified less hazard sensitive activity

Any activity not identified in the above table that is proposed in a natural hazard overlay would be assessed as a potentially hazard sensitive activity.

The sensitivity table also accounts for change in activities in existing buildings. This is a change in approach from how existing planning is undertaken for natural hazards, where consent is normally triggered for new buildings, but not for a change of activity in existing buildings. The sensitivity table allows for the consideration in the change in risk as a result of differing activities establishing themselves within a hazard area. This means that if a new sensitive activity (including the identified vulnerable activities) relocates into an existing building with an identified natural hazard overlay, then the potential risk to that activity from being present in the hazard area would need to be considered.

The second step was to map and rank the hazard return periods around whether they represented a low, medium or high hazard. The differing hazard areas are identified in Tables 4.4 and 4.5 below:

Table 4.4: Natural hazard ranking for Porirua City.

Natural Hazard Overlay	Respective Hazard Ranking
Flood Hazard – Stream Corridor	High
Ohariu Fault Rupture Zone – (20m or closer either side of the Ohariu Fault)	
Flood Hazard – Overland Path	Medium
Pukerua Fault Rupture Zone – (20m or closer either side of the Pukerua Fault)	
Flood Hazard – Ponding	Low
Moonshine Fault Rupture Zone – (20m or closer either side of the Moonshine Fault)	
Ohariu Fault Rupture Zone (excluding 20m either side of Ohariu Fault)	
Pukerua Fault Rupture Zone (excluding 20m either side of the Pukerua Fault)	

Table 4.5: Coastal hazard ranking for Porirua City.

Coastal Hazard Overlay	Respective Hazard Ranking
Tsunami – 1:100 year inundation extent	High
Coastal erosion and inundation – with existing sea level	
Tsunami – 1:500 year inundation extent	Medium
Coastal erosion and inundation - 1m Sea Level Rise Scenario	
Tsunami 1:1000 year inundation extent	Low

The District Plan then combines the sensitivity of the activity with the hazard ranking, with an increasing activity status (i.e. restrictions and making resource consent process more difficult with higher level of proof that the activity is appropriate on the site and the hazard risks are addressed) as the sensitivity of the activity and the potential severity of the hazard increases.

The proposed objectives, policies and rules seek to ensure the following outcomes are achieved:

- Avoid development for Hazard Sensitive Activities in the High Hazard Area (Non-Complying Activity);
- Discourage development for Hazard Sensitive Activities in the Medium Hazard Area and Potentially Hazard Sensitive Activities in the High Hazard Area unless appropriate mitigation measures are incorporated into the proposal;
- Generally allow, subject to mitigation measures, Hazard Sensitive Activities in the Low Hazard Area and Potentially Hazard Sensitive Activities in the Medium Hazard Area; and
- Allow for Less Hazard Sensitive Activities in all Hazard Areas (Low, Medium and High) and Potentially Hazard Sensitive Activities in the Low Hazard Area (via a Controlled Activity status).

Small scale additions to buildings for Hazard Sensitive Activities and Potentially Hazard Sensitive Activities are provided for in all Hazard Areas, subject to mitigation measures to reduce the potential damage, and the risk to life and surrounding properties is low and will not be increased by the proposal.

The activity status that aligns with the above outcomes are detailed in Table 4.6.

Table 4.6: Activity status for different sensitivity activities across the hazard zones.

Hazard Ranking	High	Medium	Low
Hazard Sensitive Activity			
Potentially Hazard Sensitive Activity			
Less Hazard Sensitive Activity			

Key

Colour	Activity Status
	Permitted
	Controlled
	Restricted Discretionary
	Discretionary
	Non-Complying

The above framework should deliver an outcome whereby there is greater consideration around the appropriateness of activities within natural hazards overlay. The sensitivity table is a step forward in terms of considering vulnerability within land use planning, and while there are opportunities for further improvements through a more refined sensitivity table, it does represent an advancement on current practice seen in many District Plans.

4.3 Civil Defence and Emergency Management

The Ministry of Civil Defence and Emergency Management (MCDEM) in New Zealand has a strong public message to "Get Ready" and "Get Prepared" for disaster events. This includes having an emergency plan for the household and for work, and having an emergency survival kit that includes enough food and water for at least three days, torches, radios, first-aid kits and equipment to make an emergency toilet[8]. However, for those without the financial resources, being prepared for a disaster is often placed low on the priority list in the face of trying to provide for day to day needs (Blake et al., 2017). This is one area where social vulnerability indicators have the potential to better inform CDEM preparedness messaging and activities to target those who are more

[8] See: https://getready.govt.nz/

disadvantaged, but there exists significant opportunity across all four phases of emergency management (readiness, response, recovery and reduction). They are also a potential tool to support the approach of the new National Disaster Resilience Strategy (Mason et al. unpub), and provide a framework from which to improve the management of risk from all natural hazards.

Following on from Mason et al. (unpub), potential other applications of social vulnerability indicators in CDEM activities include:

Readiness

- Identifying where additional support is needed within a hazard zone for emergency preparedness planning. This could include the securing of funding to provide those without the financial means with essential resources, such as rain water tanks or a basic survival kit;
- Ensuring that emergency evacuation hubs (often schools or marae) have an emergency preparedness plan in place to accommodate the likely numbers that will require help[9];
- Ensuring that evacuation planning accounts for those who do not have access to a private vehicle;
- Identifying areas that may become cut off after a disaster, and making sure that they have adequate resources to survive without external help in the immediate aftermath;

Response

- Informing decision-making about where to focus efforts and resources;
- Ensuring that response efforts are equitable and based on greatest need, rather than driven by those with the loudest voices;
- Assisting with identifying those who may be reliant on temporary shelter and housing following a natural hazard event;

Recovery

- Providing an indication of where the greatest need is likely to be for long term recovery from a disaster event and ensure that those who are most vulnerable will have access;
- Identifying where the greatest need for additional clean-up support will be;

Reduction

- Promoting the incorporation of vulnerability into land use planning (see the discussion in the section below).

[9] In recognition of the important role that marae play after a disaster, a toolkit has been designed to help marae be prepared in the event of a natural disaster or emergency (https://www.tpk.govt.nz/en/a-matou-mohiotanga/marae-development/civil-defence-marae-emergency-preparedness-plan-20).

4.4 Other Local Government Plans and Policies

Aside from those prepared under the RMA, the majority of other local government plans, policies and strategies are prepared under the Local Government Act 2002. Those that have implications for vulnerable activities include:

- Annual Plans;
- LTPs; and
- Growth Strategies.

Annual Plans and LTPs are largely financial documents, whereas Growth Strategies identify where cities and towns are going to expand into in the long term to accommodate population growth. For the purposes of this report, identifying how councils can recognise and provide for vulnerable activities will be broken down into two categories, being Annual Plans and LTPs, and Growth Strategies.

Annual and Long-Term Plans

Annual Plans and LTPs decide councils' financial commitments over one year (annual) and 10 year long-term cycles. Both of these plans are open to the public for submissions and therefore to a degree the money available is contestable. The Annual Plan and LTP processes can be one of the most effective measures for addressing natural hazard risk to vulnerable activities. This is due to these processes being the determinants of Council infrastructure upgrades and hazard mitigation works. For many existing vulnerable activities, the main way that the risk from natural hazards can be reduced is through hazard mitigation works, as the cost of relocating the activity is often too significant.

Through the LTP the location of critical infrastructure such as wastewater and potable water treatment plants outside of hazard zones can be planned for, and climate change can also be integrated in future transport and infrastructure planning. The upgrading of infrastructure to reduce natural hazard risk is associated with the vulnerability of the infrastructure itself, as opposed to the vulnerability of the community that it services. While the vulnerability of the infrastructure is an important consideration, there is the potential for the vulnerability of the activities it services to be a weighting factor when deciding what infrastructure to renew. This is due to the longer lag time it takes for vulnerable communities to recover from a natural hazard event, and that historically, communities that contain less vulnerable activities tend to have had the largest investment in services due to the competitive nature of council funding.

As previous identified, Annual Plans and LTPs go through a public submission phase. Generally speaking, vulnerable communities and activities are often poorly represented within the submission phase of these processes and as a result can be overlooked or lose funding. This is often going to communities that have less vulnerable activities, as they are better represented at the hearings for submissions on these plans and therefore have a louder voice. There are numerous reasons for why communities with less vulnerable activities are better represented at hearings including, literacy, financial well-being, education levels, awareness of political processes, migrancy status, and employment statuses. A weighting consideration within the priority ranking for

infrastructure renewal for vulnerable activities would balance the under representation that these activities experience within this competitive process.

Growth Strategies

Many councils prepare Growth Strategies under the LGA. These are essentially strategies that are identifying where cities and towns are likely to expand or intensify in the medium to longer term. These plans are getting more sophisticated, and often natural hazard information is included in determining where future urban expansion and intensification will occur. There is the opportunity within these plans to include specific recognition of where the future vulnerable activities within a town or city will be located and ensure that these areas are outside of known natural hazard areas. It is also important that consideration is given to social housing providers that have large land holdings (such as Housing New Zealand) to make sure any potential intensification of social housing in these areas is appropriate, given the natural hazard profile of the area. It is possible that in some areas, blocks of land owned by social housing providers may not be appropriate to have further intensification due to natural hazard constraints and this can be recognised within these Growth Strategies.

5. Opportunities for involvement in Local Government Processes and Key Points for Submissions

Access to political power in local government processes is one factor that has the ability to improve the resilience of vulnerable groups, by ensuring their needs and concerns are heard and addressed. The vast majority of local government strategies and plans (including those previously identified in Section 4) go through a public submission process. The period for public submission is generally four weeks (20 working days) and therefore there is limited time to get submissions in to influence the content of these documents. This section of the report outlines the best way for those groups interested in improving outcomes for vulnerable communities within local government documents and strategies to be involved in the public submission process. Recommendations include:

- If there is a chance to be on a steering or focus group on an issue, then take the opportunity. It is easier to change outcomes and get results working directly with council officers than going through the submission process;
- Most councils have lists of parties who wish to be consulted on plans and strategies. If you can get your organisation on one of these lists, then you will be advised when documents have been released for public comment;
- Keep a weekly watch on key council websites to see what plans, policies and strategies are being consulted on. This is as simple as having their consultation pages saved as bookmarks and spending five minutes each week checking these pages to see whether there is anything worth commenting on;
- When submitting on a plan, policy or strategy, make sure the submission is relevant to the topic being consulted on;
- Concentrate your efforts on the six documents that have the greatest influence on the local council and can include measures to protect vulnerable activities, being Annual Plans, LTPs, District Plans (and relevant plan changes), RPSs, Growth Strategies and CDEM Group Plans. These plans have differing timeframes for consultation for renewal. Typical timeframes include:
    - Annual Plans – Annually;
    - LTPs - Every three years;
    - Growth Strategies - Every five years;
    - District Plans - Every 10 years;
    - RPSs - Every 10 years; and
    - CDEM Group Plans - Every 10 years.

Given these timeframes, if the submission phase is missed, it can take a long time before the issue can be readdressed within these documents;

- Be factual in the submissions and if you can back points raised in the submission up with evidence then this will hold more weight than emotional arguments with no evidence;

- Write your submissions in plain English and when you are identifying a problem, make sure you identify acceptable solutions to the problem. Submissions that are solution focused have a greater uptake;

- Verbally present the submission at the hearing as these are generally more effective. It is important to make sure the main points of the submission can be presented and summarised within the allocated time (which may be between 2 mins and 30 mins depending on the committee). It is possible to request the presenting times in advance of attending the hearing so the verbal submission can be tailored to the hearing;

- Requests for changes will need to appear to be reasonable. This may not be a best practice outcome but it is better to get some improvement and recognition to an issue or outcome through a reasonable response as opposed to getting nothing from being unreasonable. Normally changes to an issue occur through numerous small incremental changes as opposed to one large step change;

- Acknowledge good points or positives in a plan, policy or strategy when they exist. This makes the submission appear balanced and will providing greater weighting towards the issues and solutions raised in the submission;

- In some instances, expert support may be required to support a submission, particularly in relation to Regional Policy Statements, District Plans, and CDEM Group Plans. Experts who know their way through the legislation and what matters can be included and inserted into a plan are likely to result in more update on the matters raised in submissions.

6. Conclusion

While the current legislative framework for managing natural hazard risk in New Zealand does provide opportunities for the inclusion of social vulnerability indicators, local government plans and policies are generally quiet on concepts of social vulnerability and how they impact upon overall community resilience. In an effort to address this shortfall, social vulnerability indicators were developed for Porirua City to better understand community resilience to flooding. In the framework applied to guide the development of the indicators, vulnerability is a function of exposure, susceptibility and resilience.

As identified, there is a number of different ways that social vulnerability indicators can be used to inform CDEM planning, land use planning and the development of plans and policies under the LGA. The case study of the proposed Porirua District Plan presents one option for including social vulnerability into a plan prepared under the RMA, that takes a risk-based approach based on the vulnerability of activities.

Key to achieving increased recognition of the issues faced by socially vulnerable groups is improved access to political power in local government processes. As such, a number of recommendations are provided on how disadvantaged individuals and the groups that represent them can achieve greater recognition with local councils and present more effective submissions, to better effect change and improved social outcomes.

This report represents only a preliminary discussion of how social vulnerability and resilience can be better incorporated into CDEM and land use planning in New Zealand. It is recognised that further practical application and research will be invaluable in progressing the recognition of social vulnerability as a key matter for consideration in local government plans and policies.

7. Acknowledgements

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Appendix A. The Risk-Based Planning Approach

A.1 The Risk-Based Approach

Traditionally the planning approach for addressing natural hazards has been based on the likelihood of an event occurring. There has been little consideration of the consequences associated with a natural hazard event where it exceeds the design standards. For example, the recent earthquake sequence in Christchurch demonstrated the potential damage that can occur to buildings and communities when an earthquake that exceeds the Building Act 2004 design standards occurs.

A risk-based planning assessment can be used to address the effects of a particular natural hazard. A risk-based assessment ensures that the economic, environmental, social and cultural consequences of a specific development are explored and quantified as part of future planning decisions.

The advantage of a risk-based assessment is that once it has been incorporated into a district plan, it allows for the consideration of the risks associated with both the construction of buildings and a change in use to an existing building. This in turn allows for more robust planning decisions to be made for a particular development or activity when determining the risks arising from natural hazards.

A risk-based approach to land use planning is based around five steps:

1. Know your hazard;
2. Determine the severity of the consequences;
3. Evaluate the likelihood of an event;
4. Take a risk-based approach; and
5. Monitor and evaluate.

These steps are interlinked, as shown in Figure A1.1.

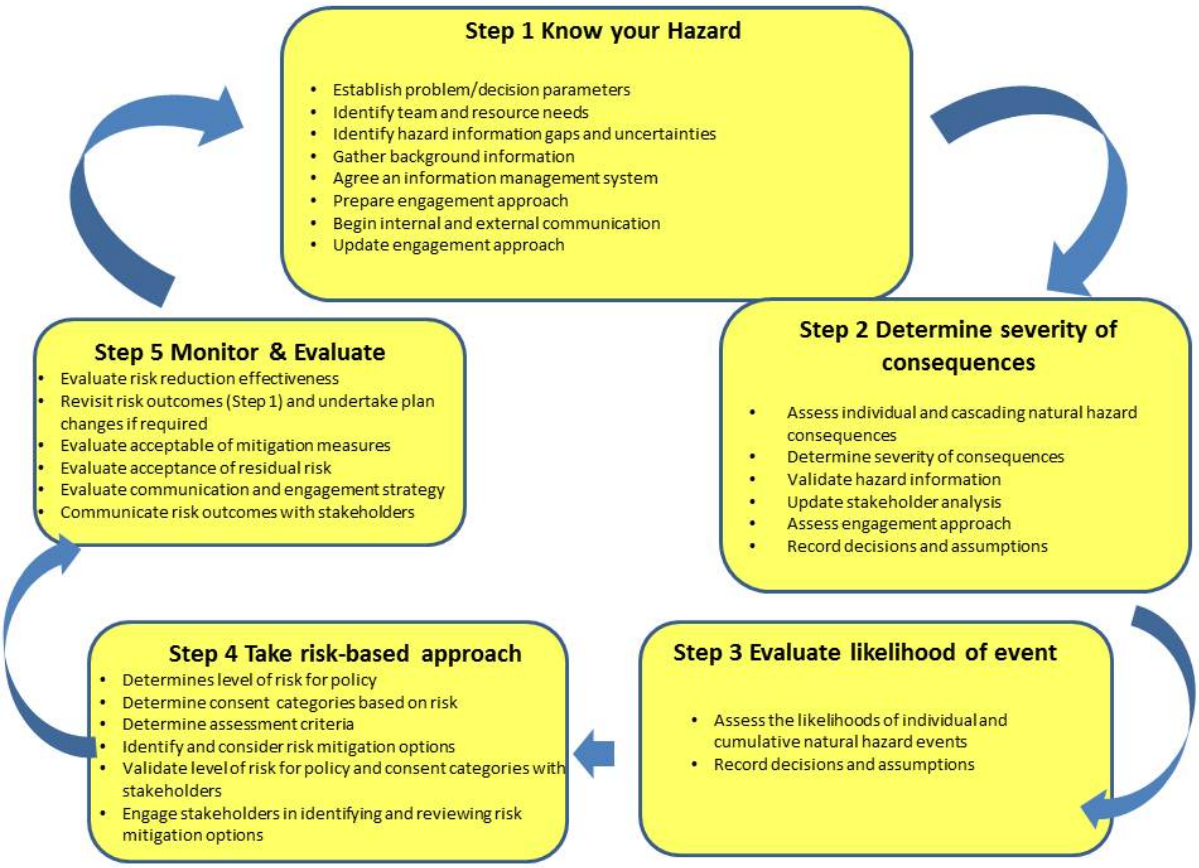

Figure A1.1 Five-step risk-based planning approach.

When undertaking a risk-based approach, a robust process for public engagement and risk communication is needed. This process is designed to ensure that the community and key stakeholders are informed of the process, can actively contribute to building an understanding of the hazard impacts, and are able to provide the council with constructive feedback leading to an agreement on the acceptability of the risk and mitigation options. This requires a two-way communication effort.

The five steps for the risk-based approach are explained in more detail below.

A.1.1 Step 1 - Know your hazard

A large amount of scoping work and information collection occurs under this step. Firstly, the nature of the planning decision needs to be identified, as this has a significant impact on the level of information required, on the stakeholders that need to be involved, and on the complexity of the risk assessments. If the planning decision is for a high-level strategic growth plan, the level of hazard and consequence information required may be less than that required for a change to a district plan. As part of this process, milestone dates for the completion of key components of the project should be identified, including the final date for delivering the product.

Once the planning decision has been made, the existing hazard information should be reviewed to determine whether it is 'fit for purpose'. Any gaps or uncertainties in the existing information should be identified. Where these gaps and uncertainties exist, appropriate experts will need to be arranged to provide reports that address these issues. This may involve contracting specialist hazard experts who do not work at the council.

While the hazard information is being collected, the information required to undertake the consequence analysis under Step 2 should start to be collated. This information includes:

- The likely land use activities that would be undertaken in the zone, including whether any lifelines will be included in the future development;
- Likely type of construction (timber frame or reinforced concrete);
- Number of additional people likely to be living in the hazard area (and the number of existing people in the hazard zone);
- The regional Gross Domestic Product (GDP); and
- Whether any buildings or places with social, cultural or post-emergency function will be located in the hazard zone.

As Step 1 can involve the collection of a large amount of information, it is important to agree on an information management strategy. This strategy needs to ensure that the information is easily accessible and identifiable to the parties who need access to it. The information management strategy also needs to consider how the information will be accessed and used once the project has been completed.

Step 1 also involves first-stage communication with stakeholders, both internal and external. This includes building a team to undertake and contribute to the project. Team members may include internal council staff from the areas of:

- Communications;
- Emergency management;
- Planners – both policy and consent;
- Elected members; and
- Scientists with expertise in the area (if on staff).

External stakeholders may also be beneficial to the team, such as:

- Scientists/researchers in the field;
- Community members;

- Business representation i.e. from business roundtables, chambers of commerce;
- Lifelines; and
- Other councils (i.e. regional council, or neighbouring territorial authority).

Early efforts at communication can shape the future of the whole engagement effort and are therefore very important. To ensure important areas are covered, an engagement strategy should be prepared.

Know your hazard assumptions

The assumptions associated with knowing your hazard are as follows:

- Any hazard assessment will be based on the best available knowledge at the time; and
- A hazard assessment report will include assumptions, limitations and uncertainties.

A.1.2 Step 2 - Consequences

The purpose of this stage is to gain an understanding of the possible consequences of a natural hazard event. Natural hazard information, coupled with information about the proposed development and existing land use, is used to undertake an assessment of consequences.

Information about the development and the natural hazard consequences is confirmed through engagement with specialists, those with local knowledge, and stakeholders.

Consequence table

Once Step 1 has been completed, the consequences from the natural hazard can be calculated (Figure A1.2). The consequences in Figure A1.2 are based on community well-beings, as well as what can be planned for. When assessing consequences, the final level of impact is assessed on the 'first past the post' principle, in that the consequence with the highest severity of impact applies. For example – a natural hazard event resulted in moderate severity of impact across all of the categories, with the exception of critical buildings, which had a 'major' severity of impact. The major impact is what the proposal would be assessed on. If a natural hazard event resulted in all of the consequences being at the same level (for example, all of the consequences are rated moderate), then the level of consequence is considered to be moderate.

The consequence table does not include a column for the environment. The reasons for this are:

- The risk-based approach has been designed for land use planning. This means it considers the interaction between human habitation and natural hazards. We do not, and are largely unable to, plan for the interaction between natural processes. For example, if a large earthquake uplifted an estuary, there is no land use planning options that could be implemented to prevent this from occurring, as it is a nature-versus-nature interaction.

- The risk-based approach concentrates on the primary (immediate) effects associated with natural hazards. Consideration was given to the effects a natural hazard can have on the environment through damaging or interrupting human processes. For example, an earthquake ruptures a pipeline and results in an oil spill. It is considered that the damage to the pipeline is a primary effect resulting from the earthquake. However, the effects on the ecosystem from the oil spill are a secondary and therefore are not considered as part of this risk-based approach.

- Other international best practice do not include environment (e.g. Integrated Research on Disaster Risk, 2011).

The consequence table has been developed as a multi-hazard table. That is, it can be used for different natural hazards – flooding, land instability, tsunami, fault rupture, liquefaction, etc. The scale of the table is such that while it provides a multi-hazard approach, not all hazards will result in catastrophic consequences. For example, a flood may never reach 'major', whereas an earthquake may.

However, if appropriate, the descriptors could be refined with further research, development, and testing. For example, if district GDP figures are available, these could be used within a district context instead of regional GDP.

Severity of Impact	Built				Economic	Health & Safety
	Social/Cultural	Buildings	Critical Buildings	Lifelines		
Catastrophic (V)	≥25% of buildings of social/cultural significance within hazard zone have functionality compromised	≥50% of affected buildings within hazard zone have functionality compromised	≥25% of critical facilities within hazard zone have functionality compromised	Out of service for > 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for > 6 months (affecting < 20% of the town/city population)	> 10% of regional GDP	> 101 dead and/or > 1001 inj.
Major (IV)	11-24% of buildings of social/cultural significance within hazard zone have functionality compromised	21-49% of buildings within hazard zone have functionality compromised	11-24% of buildings within hazard zone have functionality compromised	Out of service for 1 week – 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for 6 weeks to 6 months (affecting < 20% of the town/city population people)	1-9.99% of regional GDP	11 – 100 dead and/or 101 – 1000 injured
Moderate (III)	6-10% of buildings of social/cultural significance within hazard zone have functionality compromised	11-20% of buildings within hazard zone have functionality compromised	6-10% of buildings within hazard zone have functionality compromised	Out of service for 1 day to 1 week (affecting ≥20% of the town/city population people) OR suburbs out of service for 1 week to 6 weeks (affecting < 20% of the town/city population)	0.1-0.99% of regional GDP	2 – 10 dead and/or 11 – 100 injured
Minor (II)	1-5% of buildings of social/cultural significance within hazard zone have functionality compromised	2-10% of buildings within hazard zone have functionality compromised	1-5% of buildings within hazard zone have functionality compromised	Out of service for 2 hours to 1 day (affecting ≥20% of the town/city population) OR suburbs out of service for 1 day to 1 week (affecting < 20% of the town/city population)	0.01-0.09 % of regional GDP	<= 1 dead and/or 1 – 10 injured
Insignificant (I)	No buildings of social/cultural significance within hazard zone have functionality compromised	< 1% of affected buildings within hazard zone have functionality compromised	No damage within hazard zone, fully functional	Out of service for up to 2 hours (affecting ≥20% of the town/city population) OR suburbs out of service for up to 1 day (affecting < 20% of the town/city population)	<0.01% of regional GDP	No dead No injured

Figure A1.2 Consequence table.

Consequence table assumptions

The assumptions associated with the use of the consequence table are as follows:

- A robust public engagement and risk communication process needs to be implemented. This is to ensure that the community and key stakeholders are informed of the process and that the council can receive constructive and useful feedback.

- The hazard information a council has available is sufficiently accurate to allow for the calculation of the consequences from the hazard event. To be able to use the consequence table, the hazard information needs to be relatively detailed and scientifically robust. Furthermore, in order to be able to fill in some of the categories in the consequence table, specialist information may be required (for example a risk modeller may be required to determine the number of deaths for a given natural hazard scenario).

- It is appropriate to consider mitigation measures where they can reduce the consequences from an event. For example, an activity may be considered 'moderate' (using 'first past the post'), but with effective mitigation the consequences could be reduced to 'minor'.

- For the majority of the consequences, the severity of impact is calculated based on the level of consequences in hazard zones (for example the extent of an area affected by flooding). The use of hazards zones prevents the effects of the natural hazard event from being diluted by including buildings from a wider geographical area that are not affected by the hazard. The exception to this is the calculation of consequences from damage to lifelines. Lifelines are a network and therefore if one area of the lifeline is damaged, then it is likely to have an effect on people and property outside of the identified hazard zone.

- Not all hazard events will result in catastrophic consequences. Many natural hazard events may result in only moderate or major consequences (e.g., flood versus earthquake).

- The consequence table focuses on the primary effects associated with the natural hazard event (i.e. the immediate damage). It does not take into account secondary effects (for example the loss of employment due to damage to buildings).

- For the consequence categories for the built environment, the severity of impact is based on whether the building is functionally compromised. Functionally compromised means whether the building can continue to be used for its intended use immediately after the event. For example, if an apartment building does not have a water supply, it is unable to be used for residential accommodation, due to requirements for fire fighting. As such, the functionality of this building has been compromised by the natural hazard event.

- Critical buildings are buildings which have a post-disaster function. These include:

    - Buildings and facilities designed as essential facilities;

    - Buildings and facilities with special post-disaster functions;

- Medical emergency or surgical facilities;
- Emergency service facilities such as fire and police stations;
- Designated emergency shelters;
- Designated emergency centres and ancillary facilities; and
- Buildings and facilities containing hazardous materials capable of causing hazardous conditions that extend beyond the property boundaries.

- Social and cultural buildings are buildings that are of social and cultural importance. These include:
  - Places of worship;
  - Museums;
  - Art galleries;
  - Marae; and
  - Educational facilities.

  Sporting/recreational facilities are not included, as these are often specifically located in hazardous areas, e.g., flood paths. In some instances it is considered good practice to locate these types of activities in hazard zones, as the consequences associated with these activities can be low.

- The built environment covers all buildings not considered to fall under the definitions of critical buildings and social and cultural buildings.

- For the purposes of the consequence table, lifelines are considered to be the following:
  - Transportation;
  - Water and wastewater; and
  - Power distribution.

  These lifelines may include both networks and nodes.

- Economic consequences are measured as a percentage of Regional GDP as opposed to an absolute monetary amount (such as a dollar amount), as recommended in the Risk Management Standard (4360). This method is preferred, as the value of dollar amounts change over time, and do not allow for different scales, e.g., $1 million of loss in a small provincial town would have a greater consequence than $1 million of loss in a large city. If the data is available, the GDP of the territorial authority could be used instead of the Regional GDP. The economic category only considers the immediate economic impact and is derived using the following equation:

- ((Value of buildings damaged + (number of deaths x $3.77 million) + (number of injuries x $207,000)) / Regional GDP) x 100.

The monetary value of deaths and injuries will change with time. The value used in this formula is based on the values of deaths and injuries as a result of vehicle accidents in New Zealand.

- Deaths are an absolute number and any calculations undertaken to estimate the deaths should be rounded up when a fractional number of deaths is calculated. For example, if the calculations result in 7.1 deaths, this should be rounded up to 8.

- The risk-based approach can be used for cumulative and cascading hazards. The district plan chapter example[10] provides further information on how the consequence table can be completed for cumulative and cascading natural hazards (see: https://www.gns.cri.nz/Home/Our-Science/Natural-Hazards-and-Risks/Risk-Society/Societal-Resilience/Policy-and-Planning).

Validating local hazard impacts

The purpose of Step 2 of the risk-based approach is to build a picture of the possible consequences and impact of a natural hazard event. This stage combines technical and lay knowledge, as stakeholders may have important information about patterns of exposure that needs to be integrated into the overall assessment. This can include public expectations for the area such as future development interests, and important localities that require particular protection (e.g., key access routes and important buildings). The engagement strategy, and in particular the stakeholder assessment, should identify key stakeholders.

Risk communication at this step serves two purposes:

1. To confirm information about natural hazard consequence and key vulnerabilities by ensuring that generic knowledge and information held by the local authority is accurate at smaller scales, and takes adequate notice of community concerns.

2. To build awareness and capacity amongst stakeholders and communities to prepare for later contribution to decisions about natural hazard management and land use planning.

The engagement approach options available when undertaking this step include:

- Assessments undertaken in-house of the natural hazard consequences can be verified through surveys, field visits, interviews, and specialist working groups;

- Open days and road shows of natural hazard information depicting likely consequences at a local scale can build awareness amongst stakeholders and communities. Information regarding key concerns, locally important assets, and vulnerabilities can also be gathered this way.

[10] Beban, J.G. & Saunders W.S.A. (2013). Planning for risk – Incorporating risk-based land use planning into a district plan. Lower Hutt (NZ): GNS Science. *GNS Science Miscellaneous Series*, 63, 52p.

- Workshops that include discussion opportunities and hands-on tasks build awareness and capacity for participants to make focused contributions to land use planning decisions. Possible elements to include are:
    - Presentations of natural hazard consequences at a local scale;
    - Tangible opportunities for participants to review and discuss the likely consequences across not only life and personal property, but also the local economy, infrastructure, and significant cultural and social assets; and
    - Exercises that allow participants to come to grips with the task of ranking the severity of a risk and considering the possible management response.

The actions following on from undertaking the engagement process detailed in this step should include:

- Assess what (if any) were the main points of contention;
- Assess whether there are any major differences in perception about the hazards; which may require another communication effort;
- Revise engagement strategy and stakeholder analysis; and
- Input information into the risk-based planning approach.

Key actions for this step are as follows:

Share information:

- Hazard maps, inundation maps, overlays of current and proposed development;
- Consequence analysis – what do minor to severe events look like?
- Keep it simple.

Questions to ask and information to gather:

- If a major event happened to this locality, what would be the main issues of concern?
- What are the expectations about how this area is to be managed into the future? (e.g., housing, or commercial development)
- What are key matters affecting exposure, e.g., important buildings, access ways, vulnerable communities, important icons?
- What do people want to know more about?

Be prepared for:

- Conflicts that may arise due to stakeholders' unfamiliarity with risk estimation and the uncertainties and value assumptions associated with the method.

- This step will also reveal what are the 'sticking points' – areas of biggest concern or areas where beliefs about the hazard and associated risks are most at odds with those of hazard technical advisors.

A.1.3 Step 3 - Likelihood

Once the land use and consequences have been determined, only then should the likelihood be evaluated (Figure A1.3). For example, if a natural hazard event has a return period of 1:100 years then, using the table below, this event would be considered to be "possible" (level 4). Similarly, if a natural hazard even has a return period of 1:500 years, then it would be considered to be unlikely (level 3). The level calculated for the natural hazard is needed to complete the risk-based approach (Step 4).

Level	Descriptor	Description	Indicative frequency
5	Likely	The event has occurred several times in your lifetime	Up to once every 50 years
4	Possible	The event might occur once in your lifetime	Once every 51 – 100 years
3	Unlikely	The event does occur somewhere from time to time	Once every 101 - 1000 years
2	Rare	Possible but not expected to occur except in exceptional circumstances	Once every 1001 – 2,500 years
1	Very rare	Possible but not expected to occur except in exceptional circumstances	2,501 years plus

Figure A1.3 Likelihood scale.

As part of this step, while no formal communication with the stakeholders and general public is required, the decision around the likelihood, and the fundamental assumptions on which it was based should be recorded for the purposes of transparency and to allow for later use under Step 4.

Once the land use, consequences and likelihood have been determined (Steps 2 and 3), a risk-based approach can be applied.

Likelihood table assumptions

The assumptions relating to the use of the likelihood table are as follows:

- The likelihoods provided are accepted by key stakeholders;

- The table is scaleable, in that it allows for the evaluation of multiple hazards, i.e., flooding, landslides, tsunami, fault rupture.

A.1.4 Step 4 - Take a risk-based approach

In order to take a risk-based approach, the consequences and likelihood need to be quantified to provide a level of risk.

To achieve this, a matrix can be used that incorporates the relevant risk level, expressed as a function of consequences multiplied by likelihood (Figure A1.4). The risk then ranges from 1 (extremely low) to 25 (extremely high).

	Consequences				
Likelihood	**1**	**2**	**3**	**4**	**5**
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Figure A1.4 Quantifying consequences and likelihood.

The risk levels then need to be determined. Figure A1.5 shows how the risk levels were determined from Figure A1.4. In practice, participation and associated debate would be required within council and with the community to determine the thresholds for the levels of risk.

Risk	**Level of risk**
1-9	Acceptable
10-19	Tolerable
20-25	Intolerable

Figure A1.5 Qualifying levels of risk from Figure A1.4.

When decision makers are considering the risk levels and the planning options to address the levels of risk, they should consider the questions detailed in Table A1.1. A robust and thorough consideration of these questions

will help ensure that the right risk and consent thresholds are established, and that the objectives, policies and rules developed in response to the risk levels achieve their intended outcomes.

Table A1.1 Questions to be considered when determining levels of risk.

Acceptability	Is the risk reduction option likely to be accepted by relevant stakeholders?
Administrative efficiency	Is this risk reduction option easy to implement or will it be neglected because of difficulty of administration or lack of expertise?
Compatibility	How compatible is the risk reduction option with others that may be adopted?
Continuity of effects	Will the effects be continuous or only short term? Will the effects of this risk reduction option be sustainable? At what cost?
Cost effectiveness	Is it cost effective, could the same results be achieved at a lower cost by other means?
Economic and social effects	What will be the economic and social impacts of this risk reduction option?
Effects on the environment	What will be the environmental impacts of this risk reduction option?
Equity	Are risks and benefits distributed fairly e.g. Do those responsible for creating the risk pay for its reduction?
Individual freedom	Does the risk reduction option deny any basic rights?
Jurisdictional authority	Does this level of organisation or government have the authority to apply this option? If not, can higher levels be encouraged to do so?
Leverage	Will the risk reduction option lead to additional benefits in other areas?
Objectives	Are organisational objectives advanced by this risk reduction option?
Regulatory	Does the risk reduction option (or lack of option) breach any regulatory requirements?
Political acceptability	Is it likely to be endorsed by the relevant government authority? Will it be acceptable to communities?
Risk creation	Will this risk reduction option introduce new risks?
Timing	Will the beneficial effects be realised quickly?

Once levels of risk have been determined, the matrix is then colour-coded (Figure A1.6), based on the levels of risk shown in Figure A1.5. The use of colours allows a faster assessment of the levels of risk involved. The colours of green and blue (acceptable i.e. permitted/controlled), yellow and orange (tolerable with consent i.e. restricted discretionary, discretionary) and red (intolerable i.e. non-complying, prohibited – see Figure A1.7), are considered standard colours for this approach.

	Consequences				
Likelihood	**1**	**2**	**3**	**4**	**5**
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Figure A1.6 Colour-coding the matrix based on level of risk.

The stage uses the colours, based on the levels of risk, to determine the consent status (i.e., treatment) of the activity (Figure A1.7).

Level of risk	**Consent**
Acceptable	Permitted
Acceptable	Controlled
Tolerable	Restricted Discretionary
Tolerable	Discretionary
Intolerable	Non complying, prohibited

Figure A1.7 Level of risk and associated consent status.

Non-complying and prohibited are merged together, but it is acknowledged that the former allows for development, while the latter avoids development. For the purposes of this example, the two are merged to allow for high consequence activities to take place in high-risk areas that may not be able to be avoided, e.g., a port.

In the final stage of the process, consequence values 1–5 are relabelled into roman numerals to ensure no confusion between the likelihood scale and consequence scale. Figure A1.8 provides the final framework, where risk equates to consent status applied.

	Consequences				
Likelihood	**I**	**II**	**III**	**IV**	**V**
5					
4					
3					
2					
1					

Figure A1.8 The risk-based planning framework.

Not all consent categories may be required. The consent categories that are used need to relate to the level of risk associated with the hazard, and the desires of the community to address this risk. As such, it may be that a council chooses to use only the following consent categories when implementing the risk-based approach: permitted, discretionary, and non-complying.