

New Zealand Natural Hazard Risk Management Framing

Final report

Prepared for Ministry for the Environment – Manatū Mō Te Taiao
Prepared by Beca Limited

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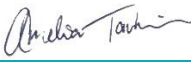
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Climate change is an evolving field, with uncertainty inherent in projections of future conditions, and unknowns which cannot be precisely estimated with present science. These matters should be considered by the Client as part of any decision-making and planning.

Regular monitoring of evolving practice and regular review and updates of the work contained in this report to take account of developments in scientific knowledge and changes in international and national guidance should be undertaken.

This report is not intended to provide financial, investment, or legal advice. It should not be used as the sole basis for making financial or strategic decisions. Clients are encouraged to seek professional advice in these areas.

Abbreviations

AGS	Australian Geomechanics Society
ALARP	As Low As Reasonably Practicable
CBA	Cost-Benefit Analysis
CCR Act	Climate Change Response Act 2002
CDEM	Civil Defence and Emergency Management
CDEM Act	Civil Defence Emergency Management Act 2002
DIA	Department of Internal Affairs
DOC	Department of Conservation
DPMC	Department of the Prime Minister and Cabinet
ESNZ	Earth Sciences New Zealand
EQC	Earthquake Commission
FMA	Financial Markets Authority
GDP	Gross Domestic Product
GNS	Institute of Geological and Nuclear Sciences (GNS Science) (now Earth Sciences New Zealand)
ISO	International Organization for Standardization
LIM	Land Information Memorandum
LGA	Local Government Act 2002
LTP	Long-Term Plan
MBIE	Ministry of Business, Innovation and Employment
MEL	Monitoring, Evaluation and Learning
MfE	Ministry for the Environment (Manatū Mō Te Taiao)
NAP	National Adaptation Plan
NCCRA	National Climate Change Risk Assessment
NBS	New Building Standard (%NBS)
NEMA	National Emergency Management Agency
NHC	Natural Hazards Commission
NIWA	National Institute of Water and Atmospheric Research (now Earth Sciences New Zealand)
NISWE	North Island Severe Weather Event(s)
NPS-NH	National Policy Statement for Natural Hazards
NZCPS	New Zealand Coastal Policy Statement
NZFOA	New Zealand Forest Owners Association
NZGS	New Zealand Geotechnical Society
NZS	New Zealand Standard
RMA	Resource Management Act 1991
4Rs	Reduction, Readiness, Response and Recovery
TS	Technical Specification
UNDRR	United Nations Office for Disaster Risk Reduction

Glossary

Term	Definition
Adaptation	The process of adjustment to actual or expected natural hazards, climate change and their effects to reduce harm, manage risk and take advantage of opportunities (IPCC, 2022; He Pou a Rangi Climate Change Commission, 2026).
Cascading risk	Risk arising from impacts that trigger a chain of consequences across interconnected systems, sectors or communities.
Compounding impacts	Arise from the interaction of hazards, which may be characterised by single extreme events or multiple coincident or sequential events that interact with exposed systems or sectors (He Pou a Rangi Climate Change Commission, 2026).
Consequence	Outcome of an event affecting objectives (ISO 31000: 2018).
Disaster	A serious disruption of the functioning of a community or society due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to losses and impacts (UNDRR, 2017).
Exposure	The presence of people; livelihoods; species or ecosystems; environmental functions, services and resources; infrastructure; or economic, social or cultural assets in places and settings that could be adversely affected (IPCC, 2022).
Functions	A distinct area of activity within the natural hazard risk management system that contributes to the management of risk through specific objectives, responsibilities, decision-making processes and instruments. In this report, the example functions are land-use planning, infrastructure design and emergency management.
Hazard	The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other adverse impacts (IPCC, 2022).
Instrument	A legislative, regulatory, policy, guidance or operational mechanism that influences how natural hazard risk is understood, assessed, managed or governed.
Likelihood	Chance of something happening (ISO 31000: 2018).
Multi-hazard risk	Risk arising from the interaction, coincidence or cumulative effects of multiple hazards.
Natural hazard	A naturally occurring physical event or process that may cause adverse impacts on people, communities, infrastructure, the environment or cultural values.
Non-stationarity	A condition in which the statistical characteristics of a hazard or risk change over time rather than remaining constant.
Residual risk	Risk remaining after risk treatment (ISO 31000: 2018).
Resilience	The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation (IPCC, 2022).
Risk	Effect of uncertainty on objectives (ISO 31000: 2018).
Risk criteria	Terms of reference against which the significance of a risk is evaluated (ISO 31000: 2018).
Risk management	Coordinated activities to direct and control an organization with regard to risk (ISO 31000: 2018).
System	The collection of actors, institutions, instruments, processes and relationships that collectively influence the management of natural hazard risk.

Term	Definition
System-level risk	Risk arising from interactions and interdependencies across multiple system functions, sectors or organisations that cannot be fully understood or managed within a single decision-making context.
Uncertainty	A state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable (IPCC, 2022).
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC, 2022).

Glossary definitions are drawn from authoritative sources in the following order of precedence: (1) ISO 31000: 2018 for risk management terminology; (2) the National Climate Change Risk Assessment (2026), where relevant; (3) the IPCC Sixth Assessment Report (2022) for climate and risk concepts not defined in ISO; and (4) United Nations Office for Disaster Risk Reduction (UNDRR) (2017) where no suitable definition was identified in the preceding sources. Where a term is not explicitly defined in these sources, a report-specific definition has been adopted.

Executive summary

Aotearoa New Zealand faces increasing exposure to natural hazards, driven by climate change, growing asset bases and interconnected infrastructure systems. While there is extensive activity across central and local government, the current natural hazard risk management system lacks a shared, system-level framing to ensure that this activity operates coherently.

This report responds to that gap by analysing a substantial suite of legislation, strategies, frameworks, standards, guidance and funding mechanisms across hazards and sectors, and using *NZS ISO 31000: 2025 – Risk Management Guidelines* (ISO 31000) as a common organising reference to examine current practice and identify opportunities to improve system coherence.

Purpose and approach for this report

The purpose of this report is to provide advice on how natural hazard risk management could be framed to improve coherence across functions, consistency within functions, and comparability across hazards. It is intended to inform engagement on the development of new and emerging instruments (including *NZS 9420: Risk analysis* and *NZS 9421: Flood hazard modelling and risk assessment*) and to reduce the risk of fragmentation created when individual instruments define system-level concepts in isolation.

The analysis adopts ISO 31000 as a common organising lens, examining how its Principles, Framework and Process are currently reflected across New Zealand's risk management system. This approach enables identification of where variation is appropriate, and where it creates barriers to coherent system-level decision-making.

Key findings: coherence challenges and implications for the system

The system is structurally fragmented, limiting its ability to achieve coherent risk management outcomes across functions

Natural hazard risk management is supported by an extensive and growing set of instruments operating across land-use planning, infrastructure design and emergency management. While each function is internally coherent (to a large extent), they have evolved separately, resulting in:

- weak alignment across functions
- inconsistent implementation across regions
- no mechanism to ensure coherent system-level outcomes.

As a result, decisions are often shaped by the priorities and requirements of individual functions rather than a shared view of system-level risk. The same community may be managed under multiple parallel risk frameworks, for example, land-use restrictions may reflect long-term hazard risk while infrastructure continues to be designed to different standards and timeframes. This can result in uneven protection for communities, potentially higher long-term costs, and less efficient implementation of strategic risk management objectives.

Variation is necessary, but unmanaged variation reduces transparency, consistency and confidence in decision-making

Variation across hazards and decisions contexts is expected. However, there are no consistent mechanisms to make differences explicit, interpret them consistently and reconcile them across decision contexts.

This leaves variation as an ungoverned dimension, only becoming visible when conflicts arise. Comparable risks may be assessed differently across regions or hazards, not because of context, but due to inconsistent methods or assumptions.

The absence of a shared basis for comparing and aggregating risk constrains system-level prioritisation and decision-making

Risk is expressed in multiple ways (probabilistic metrics, qualitative matrices, scenarios, performance thresholds), all valid individually but not directly comparable. Without a translation mechanism, the system cannot prioritise investment across hazards, manage cascading and interdependent risks effectively or determine relative risk significance. This is a critical limitation for system-level decision-making.

The system is not configured to support proactive management of dynamic and interconnected risk

Risk is increasingly dynamic and interconnected, yet operational practice remains largely functionally bounded. Key gaps include limited consideration of cascading risks below national level, inconsistent handling of climate-driven uncertainty and fragmented monitoring and review.

This creates a disconnect between system-level risk understanding and operational decision-making. This limits the system's ability to respond proactively to changing risk, reinforcing a reactive, event-driven approach rather than one based on continuous understanding and adaptation.

Coherence challenges across ISO 31000 components

Across the Principles, Framework and Process, the analysis identifies recurring themes:

- **Principles:** broadly aligned, but unevenly operationalised – particularly for integration, use of best available information, and incorporation of community and cultural perspectives.
- **Framework:** relatively coherent within functions, but fragmented across them, with no clear system-level governance or stewardship for coherence.
- **Process:** widely applied but highly variable, with major challenges in risk analysis, communication, and recording/reporting.

These challenges are interconnected: weaknesses in frameworks and governance contribute to inconsistent process implementation, which in turn limits the system's ability to reflect effective risk management principles at a system level.

Considerations for future system development

The system does not lack capability – it lacks structures to translate capability into coherent outcomes. Three key areas for consideration follow:

- 1. System-level framing is required:** Improving individual instruments in isolation will not resolve fragmentation. Future instruments must explicitly recognise their role within a wider system.
- 2. Variation must be governed:** Rather than reducing variation, the system should make assumptions explicit, establish shared terminology and enable translation between approaches.
- 3. Mechanisms are needed to reconcile decisions:** Improved coherence requires translation and moderation between risk approaches (including defining criteria and risk analysis methods), clearer links across assessment, evaluation and treatment, and minimum shared requirements for reporting and monitoring and evaluation.

Conclusion

Natural hazard risk management in Aotearoa New Zealand is extensive and, in many areas, well-developed. However, its effectiveness at a system level is constrained by fragmentation, unmanaged variation and the absence of shared structures to align decisions across hazards, sectors and scales.

This framing report provides a foundation for addressing these challenges by establishing a shared technical reference based on ISO 31000, enabling more coherent development of future instruments and more consistent, transparent and effective system-level risk management over time.

1 Introduction

1.1 Background

There is a growing body of work underway across central and local government on natural hazards, adaptation, emergency management, planning reform and risk-related standards. Despite this, there remains a lack of shared system-level understanding and alignment on how ‘end-to-end’ natural hazard risk management should operate in Aotearoa New Zealand.

There is also inconsistency in how internationally recognised risk management standards are applied, particularly *NZS ISO 31000: 2025 – Risk Management Guidelines* (ISO 31000). Although ISO 31000 is designed for organisational risk management, its flexible, principles-based approach means it is frequently extended to community, regional and asset-level contexts. Within these contexts, it is applied in different ways across hazards, sectors and decision-making settings, without a shared framing to support coherence.

‘End-to-end’ natural hazard risk management spans the full lifecycle of risk: from identifying hazards and understanding their associated risks, through to mitigating impacts, preparing for events, responding and supporting recovery. In New Zealand, this lifecycle is reflected in the ‘4Rs’ – Reduction, Readiness, Response and Recovery – established under the Civil Defence and Emergency Management (CDEM) Act 2002.

Across the system, risk management is undertaken through a range of functions including land-use planning, infrastructure design and emergency management. These functions operate with different objectives, timeframes, responsibilities and decision-making contexts, and approaches vary across scales, regions and organisations. Risk is also characterised and analysed differently across hazards, reflecting variations in data availability, methodological approaches and underlying assumptions. In part, these differing approaches have evolved to account for natural hazards influenced by a changing climate, where likelihoods and consequences are not static but shift over time, further complicating efforts to achieve a consistent approach to risk management.

While such variation is often appropriate, the absence of a shared system-level framing limits overall coherence. Differences in concepts, terminology and processes make it challenging to align decisions across functions, enable consistency within them, and compare risks across hazards (including compounding and cascading multi-hazard risks). This constrains the ability to manage trade-offs, prioritise investment and support transparent, consistent decision-making at a system level.

These challenges are becoming more consequential as agencies progress natural hazard and adaptation related work streams in parallel, including *NZS 9420: Risk analysis* (NZS 9420) and *NZS 9421: Flood hazard modelling and risk assessment* (NZS 9421). Without a common framing, differences in practice and interpretation of ISO 31000 and related instruments risk reinforcing fragmentation across the natural hazard risk management system.

A common technical reference would help establish shared concepts and structure, support alignment where it matters, and provide more coherent foundations for natural hazard risk management in New Zealand.

1.2 Purpose of this report

The purpose of this report is to provide advice on the framing of natural hazard risk management at a system level in New Zealand. It aims to support and inform the development of natural hazard risk management instruments (including NZS 9420 and NZS 9421), and reduce the risk that individual instruments define system level concepts or assumptions in isolation.

To examine how the system operates in practice, this report focuses on three example functions of natural hazard risk management. A function is a distinct area of activity within the wider system, characterised by its

own objectives, responsibilities, decision-making processes and supporting instruments. The three example functions considered in this report are:

- **Land-use planning** – managing where and how development occurs in areas exposed to natural hazards.
- **Infrastructure design** – managing risk through the planning, design, construction and operation of buildings, infrastructure and lifeline networks.
- **Emergency management** – managing risk through reduction, readiness, response and recovery activities before, during and after hazard events.

These functions are used as illustrative examples throughout the report. They have been selected because they represent major pathways through which natural hazard risk is managed in Aotearoa New Zealand and because they frequently interact in practice when managing the same underlying risks

The analysis focuses on three interrelated dimensions of system performance:

- **Coherence across functions** – the extent to which different functions of the system operate in an aligned and mutually reinforcing way. A coherent system does not require functions to use identical approaches, but it does require decisions affecting the same risks, places and communities to be understandable, compatible and capable of contributing to shared system-level outcomes.
- **Consistency within functions** – the extent to which similar risks are managed in similar ways within a particular function, unless there is a clear and justifiable reason for variation. Consistency is concerned with reducing unnecessary differences in practice between organisations, regions and decision-making contexts.
- **Comparability across hazards** – the extent to which risks arising from different hazards can be understood, interpreted and, where necessary, compared in a meaningful way. Comparability supports understanding of cascading and compounding multi-hazard risks, informs prioritisation and investment decisions, and enables consideration of risk at a system level.

These dimensions are distinct but closely related. A system may be internally consistent within individual functions, yet still lack coherence if those functions are poorly aligned with one another. Similarly, coherence across functions can be difficult to achieve where risks cannot be compared or interpreted consistently across different hazards. Together, these dimensions provide a basis for assessing how effectively the natural hazard risk management system operates as a whole.

The report uses ISO 31000 as a common scaffolding for examining natural hazard risk management in New Zealand, drawing on relevant instruments such as legislation, policies, guidance and standards. Using this lens, it identifies where variation in practice undermines system coherence and where greater alignment is needed, while recognising that some variation is appropriate and should be accommodated.

The analysis does not assume that variation is inherently problematic. Variation is considered appropriate where it reflects differences in statutory purpose, decision context, scale, hazard characteristics or risk tolerance. Variation is considered a challenge where it reduces coherence across functions, results in materially different treatment of similar risks within functions without a clear rationale, limits comparability across hazards, or relies on assumptions that are not explicit or cannot be readily reconciled across the wider system.

This report is intended to:

- Provide a system-level framing and shared technical reference to inform and contextualise ongoing and future work on natural hazard risk management in New Zealand.
- Support discussion across teams and agencies on how natural hazard risk management instruments could be framed if applying an ISO 31000-based approach more systematically, including key choices, trade-offs and implications.
- Be practical, testable and open to feedback and refinement as the system and shared understanding evolve.
- Inform engagement with internal and external stakeholders, including Department of Prime Minister and Cabinet (DPMC), National Emergency Management Agency (NEMA) and Natural Hazards Commission (NHC).

This report does not constitute guidance itself, but provides a foundation to support engagement, more coherent development and application of such instruments over time.

1.3 Scope of natural hazards

The following natural hazards are considered in this analysis. Many of these hazards are already being exacerbated by climate change, which is influencing their frequency, intensity and spatial distribution.

- | | |
|---|---------------------|
| • Flooding | • Tsunami |
| • Coastal erosion | • Volcanic activity |
| • Coastal inundation | • Drought |
| • Landslips (also referred to as landslides and rockfall) | • Heatwaves |
| • Severe weather (cyclones, storms) | • Wildfire |
| • Earthquakes | • Avalanche |
| • Liquefaction | • Space weather |

While this report considers a broad range of natural hazards, the depth and maturity of available information varies significantly between hazards. The analysis is therefore focused on identifying system-level patterns, assumptions and coherence challenges, rather than providing a comprehensive assessment of risk management practice for every hazard. Examples are used throughout the report to illustrate key issues, but these should not be interpreted as a complete representation of all hazard-specific approaches, guidance or decision contexts. The breadth of hazards considered necessarily means that some simplification has occurred, particularly where hazard-specific governance arrangements, analytical methods or operational practices differ in important ways.

Furthermore, a distinction is made between *natural hazards* and *disasters*. Natural hazards are potentially damaging physical events or processes. Disasters occur when these hazards interact with exposed and vulnerable people, assets or systems, resulting in impacts that exceed the ability of the affected community or system to cope using its own resources (UNDRR, 2017).

The concept of disaster risk management is well established and spans the full continuum of activities across the 4 Rs to reduce, prepare for, respond to, and recover from impacts. In this report, the term 'natural hazard risk management' is used to emphasise this same end-to-end perspective. It focuses on understanding and managing the full range of risks arising from natural hazards – including those that may exceed system capacity – in order to prevent hazards from resulting in disasters, reduce their impacts where they do occur, and support effective response and recovery.

1.4 Structure of this report

This report is structured as follows:

Section 2 sets out the case for a shared, system-level framing of natural hazard risk management in Aotearoa New Zealand. It describes the current landscape and summarises key challenges relating to coherence across functions, consistency within functions, and comparability across hazards.

Section 3 presents a high-level system view of natural hazard risk management using ISO 31000 as an organising reference. It illustrates how existing instruments collectively operate across the system and highlights areas of alignment, divergence, and appropriate variation.

Sections 4 – 6 provide a detailed assessment of current practice using ISO 31000 as an organising reference, structured around its three core components:

- **Section 4** examines the ISO 31000 **Principles**.
- **Section 5** examines the ISO 31000 **Framework**.
- **Section 6** examines the ISO 31000 **Process**.

Each section follows a consistent analytical structure (illustrated in Figure 1), assessing where current practice aligns with ISO 31000, where variation creates challenges for coherence across functions, consistency within functions, or comparability across hazards, and what this means for the system.

Section 7 synthesises the findings and sets out key implications and considerations for improving coherence across the natural hazard risk management system in New Zealand, providing a basis for discussion, testing and future development.

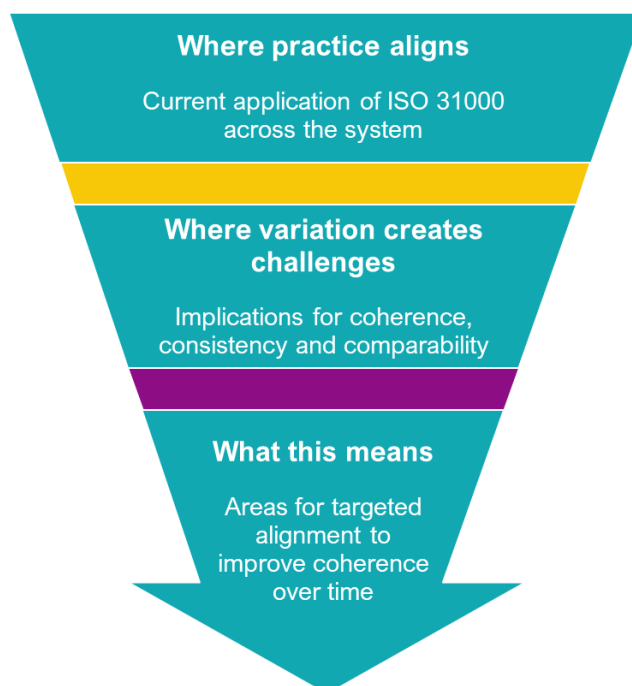


Figure 1: Structure of key insights presented in Sections 4-6 of this report.

2 The need for a shared, system-level understanding

2.1 Current state of natural hazard risk management in Aotearoa New Zealand

Natural hazard risk management in Aotearoa New Zealand is supported by a large and evolving suite of instruments operating across national, regional, local and sector levels. Rather than operating as a single coherent system, these instruments perform different and overlapping roles. Some operate system-wide, shaping how risk is framed and managed across sectors and scales, while others are more directly aligned to specific functions.

The instruments described in this section are organised by type – legislation and regulation, strategies, frameworks and plans, standards and guidance, and funding and investment – as well as by system function. In practice, however, most instruments operate across more than one function, and the same instrument often shapes more than one function simultaneously. This crosscutting character is both a feature of the system's breadth and a source of the coherence challenges described in section 2.2.

Analysis in this report is focused on three example system functions (land-use planning, infrastructure design and emergency management), to explore different modes and use cases of natural hazard risk management and the activities that legislation seeks to manage. A full mapping of key instruments against the three example functions is provided in Appendix A for reference. Sector- and geography-specific instruments such as guidance produced by local councils have been excluded from the scope of this report.

2.1.1 Legislation and regulation

Legislation and regulation form the foundation of the system and set the primary mechanisms through which risk is managed across functions:

- The *Resource Management Act 1991* (RMA) primarily shapes land-use planning, influencing where and how development occurs in hazard-prone areas. Under the RMA, National Policy Statements provide further specific direction on natural hazards risk management including the *National Policy Statement for Natural Hazards* (NPS-NH) (2025) and the *New Zealand Coastal Policy Statement* (NZCPS) (amended in 2025) which provides direction for coastal hazards.
- The *Building Act 2004* (Building Act) and the Building Code shape infrastructure design, setting minimum performance standards for buildings under hazard conditions.
- The *Civil Defence Emergency Management Act 2002* (CDEM Act) underpins emergency management, establishing responsibilities across reduction, readiness, response and recovery.
- The *Local Government Act 2002* (LGA) underpins long-term planning and infrastructure investment decisions at local government level (including via the Long-Term Plans (LTPs) and asset management), shaping how risk is prioritised and funded locally.
- The *Natural Hazards Insurance Act 2023* supports risk transfer, influencing decisions across property, infrastructure and recovery.
- The *Climate Change Response Act 2002* (CCR Act) operates system-wide, shaping how long-term and climate-related risks are identified and addressed across all functions.
- The *Financial Sector (Climate-related Disclosures) Amendment Act* shapes risk identification, assessment and disclosure within the financial system, requiring certain organisations to systematically consider and communicate their exposure to climate-related risks, particularly to investors and stakeholders.
- At the hazard-level, fire management (encompassing wildfires) is legislated under the *Fire and Emergency New Zealand Act 2017* (FENZ Act).

Together, these statutes address natural hazard risk from complementary perspectives, but operate through different mandates, decision processes and timeframes.

Legislative reform is actively underway. The *Emergency Management Bill (No 2) 236-1 (2025)* proposes changes to roles and coordination within the emergency management system, replacing the CDEM Act. Resource management reform, including the Planning Bill (2025) and Natural Environment Bill (2025), aims to unlock infrastructure and housing development in appropriate places to drive growth whilst protecting what is important and adapting to the effects of climate change and natural hazard-related risks.

2.1.2 Strategies, frameworks and plans

A range of national strategies, frameworks and plans provide cross-cutting direction, influencing how risk is understood and prioritised across all functions rather than directly regulating decisions.

The National Risk and Resilience Framework (DPMC, 2025) provides the overarching national-level structure for managing risk across government, covering 28 nationally significant risks spanning natural hazards, national security, economic and other threats. Sitting within this broader system, the National Disaster Resilience Strategy 2019-2029 (2019) sets out the vision and long-term goals specifically for CDEM, providing a common agenda that organisations, agencies and communities can align with. Strengthening Disaster Resilience and Emergency Management (DPMC, 2024) builds on this, setting out the Government's programme of change for the emergency management system in response to the North Island Severe Weather Event (NISWE) Inquiry (DIA, 2024).

Climate-related natural hazard risks are addressed through National Climate Change Risk Assessments (NCCRA) (2020; 2026) and the National Adaptation Plan (NAP) (2022), established under the CCR Act. The National Adaptation Framework (MfE, 2025) introduces a broader system-level approach, structured around four pillars – information, roles, investment and cost-sharing – informing better land-use planning, infrastructure and emergency management. These instruments set strategic direction but do not directly regulate decisions; implementation depends on how policy and planning, infrastructure and emergency management systems give effect to them in practice.

At the regional and local level, national direction is translated into function-specific decision-making through statutory plans and operational instruments:

- Regional Policy Statements and district plans are the primary tools for implementing risk management through land-use planning, determining spatial patterns of development and associated restrictions.
- CDEM Group Plans operationalise national direction across emergency management, including reduction, readiness, response and recovery activities.
- Iwi or Hapū Management Plans inform planning decisions and contribute to how hazard risk is understood and managed in specific places, reflecting iwi and hapū priorities.

However, their scope, quality and embedded risk approaches vary considerably across the country's sixteen regions, reflecting differences in capability, data and local context (MfE, 2025; Manaaki Whenua, 2024; DPMC & MfE, 2025).

2.1.3 Standards, guidance, research, science and data

Across all levels of the system sits a wide range of hazard-specific and sector-specific standards, guidance, research and data, which underpin how risk management is undertaken across all three functions. Maturity remains uneven though, with significant variation in the availability, consistency and application of hazard and risk assessment methods, data and guidance across different hazards and sectors.

A small number of instruments speak directly to how risk is assessed and managed across the system. The *Director's Guidelines for CDEM Groups, Risk Assessment: Guidance for CDEM Group Planning* (NEMA, 2022) (hereafter, CDEM Risk Guidance) and the NHC Risk Tolerance Methodology (NHC, 2025) provide methodological direction within and beyond the emergency management function. The emerging NZS 9420 and NZS 9421 will, once finalised, provide important reference points for how risk is identified, analysed and

evaluated across all functions. Within the financial sector, the Aotearoa New Zealand Climate Standards (issued by the External Reporting Board (XRB)) also provide a structured framework for identifying, assessing and disclosing climate-related risks and opportunities, supporting greater consistency in how organisations understand and communicate these risks, particularly over the short, medium and long term.

Beyond these, key hazard-specific standards and guidance include:

- **Seismic hazards:** AS/NZS 1170 structural design standards series, including TS 1170.5: 2025 for earthquake actions, Seismic Risk Guidance for Buildings (MBIE, 2022), and Planning and engineering guidance for liquefaction-prone land (under Section 175 of the Building Act 2004).
- **Landslides:** GNS Landslide Planning Guidance (GNS Science, 2024), New Zealand Geotechnical Society (NZGS) Slope Stability Guidance (NZGS, 2022), and the Australian Geomechanics Society (AGS) Guidelines for Landslide Risk Management (2007) (hereafter, AGS Guidelines), which are currently undergoing update for Australia and New Zealand.
- **Flooding and coastal hazards:** Preparing for Future Flooding (MfE, 2010), National Stormwater Modelling Guide (Water NZ, 2024), and NZ Coastal Hazards and Climate Change Guidance (MfE, 2024) (hereafter, NZ Coastal Guidance).
- **Other hazards:** Forest Fire Risk Management Guidelines (NZFOA, 2025), Fire Risk Assessment (NIWA, 2017), Assessment and Planning for Tsunami Vertical Evacuation (MCDEM, 2018), Integrating tsunami inundation modelling into risk-based land-use planning (Beban et al., 2019), Resilient Homes – wind and storms (MBIE, 2025), Guidelines for DOC Volcanic Risk Management in Tongariro National Park (DOC, 2023), and the National Space Weather Response Plan (NEMA, 2024).

Underpinning all of this is national hazard science and data produced by NHC, Earth Sciences New Zealand (ESNZ) and MetService. The quality, consistency and accessibility of this underlying science directly shape what risk assessment is possible across functions and hazards. The Natural Hazards Portal (NHC, 2024), GeoNet and other similar websites provide key national access points for hazard information and monitoring data.

2.1.4 Nationally implemented funding and investment

The system is also supported by a range of funding and investment mechanisms, which influence whether and how risk management actions are implemented across functions. These include the Regional Infrastructure Fund (\$200 million for flood resilience) (Kānoa Regional Economic Development & Investment Unit, 2025), the CDEM Resilience Fund administered by NEMA and the Natural Hazards Fund administered by NHC. Notably, funding settings are not always aligned with planning or regulatory signals, contributing to inconsistencies in how risk is managed in practice.

2.2 System-level challenges: fragmentation, complexity and inconsistency

Despite the breadth of work described in section 2.1, the system has grown organically across agencies, hazards and decision contexts rather than as a coherent whole. The result is a system that is simultaneously comprehensive and fragmented – with significant activity underway across land-use planning, infrastructure design and emergency management, but without the shared foundations needed to ensure that activity adds up to coherent, system-level risk management. Four interconnected challenges illustrate this in Figure 2.

A fragmented institutional landscape is recognised as one of these system-level challenges – particularly in shaping roles, responsibilities, accountability and coordination. However, this is not examined in detail in this framing report given the ongoing legislative reform. The analysis instead focuses on the consistency and coherence of risk management approaches (including assessment, evaluation and treatment), providing a foundation for understanding how institutional fragmentation manifests in practice, rather than examining governance structures directly.

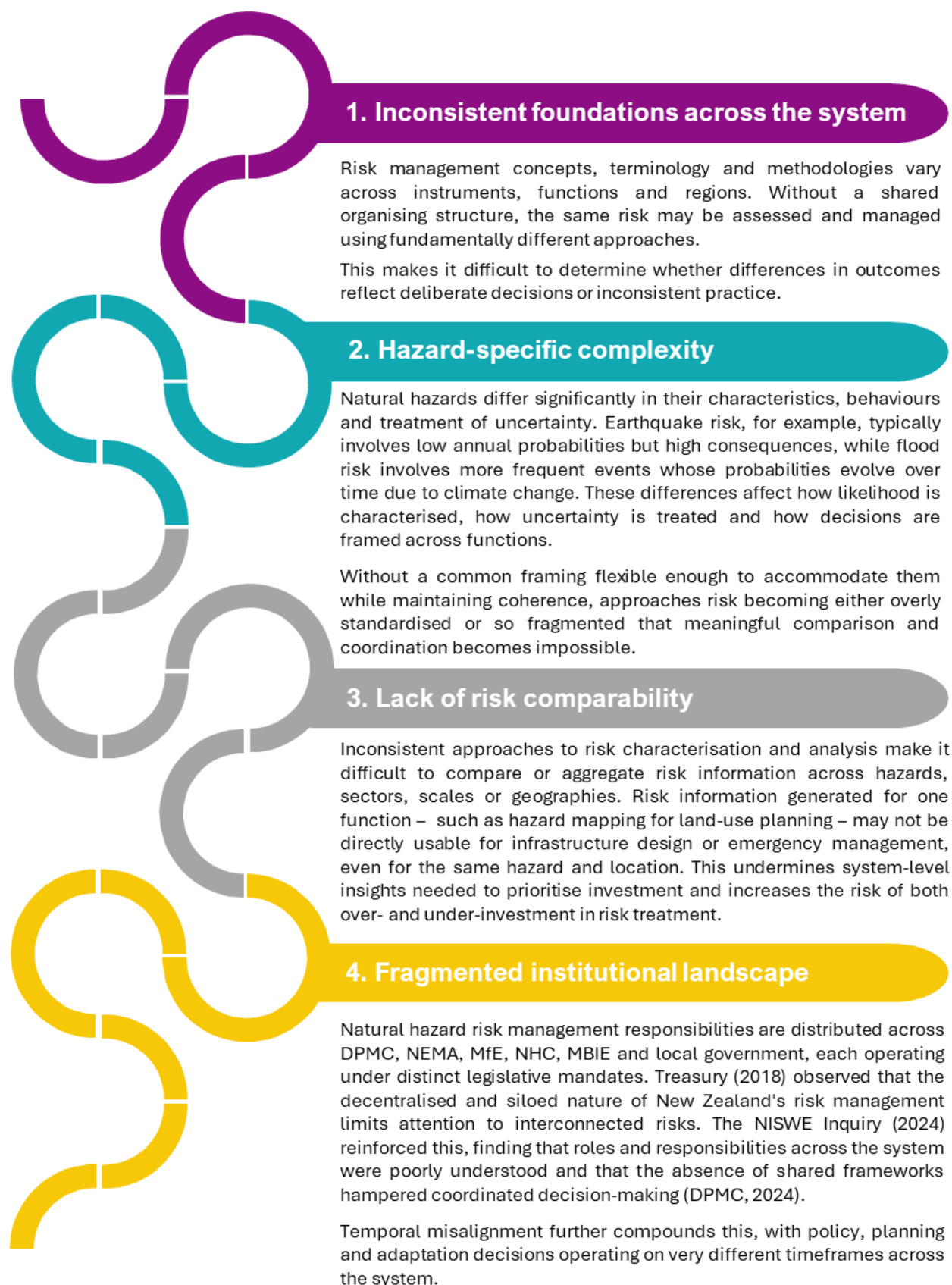


Figure 2: Interconnected challenges impeding natural hazard risk management system coherence.

2.3 Value of a shared technical reference

Addressing these challenges does not require a single uniform approach to natural hazard risk management – the diversity of hazards, sectors and decision contexts makes that neither practical nor desirable. Rather, the case is for a shared system-level framing that sits above existing (and future) instruments and provides a common reference point from which hazard- and function-specific application can proceed.

This report does not provide recommendations on how to resolve the fragmentation described in section 2.2 – much of that fragmentation is structural and institutional, and will require coordinated action across agencies over time. Instead this report provides recommendations on a potential framing to address the conceptual fragmentation that underlies it: the absence of shared language, explicit assumptions and a common organising structure that would allow agencies to have more productive conversations about risk characterisation, tolerance, trade-offs and priorities across functions and hazards.

More specifically, this shared technical reference offers four practical contributions.

- 1. Making implicit assumptions explicit and contestable.** Much of the inconsistency in the system exists because core concepts – risk, likelihood, consequence, tolerance – are embedded implicitly within instruments without being defined or justified. Making these explicit, and identifying where they diverge across functions and hazards, allows decision-makers to determine whether differences reflect deliberate choices or inconsistent practice. That distinction is a precondition for more coherent system-level decision-making.
- 2. Establishing a shared language for cross-agency conversations.** Without common terminology and a shared organising structure, agencies cannot easily discuss risk thresholds, investment priorities or trade-offs. A common technical reference creates the foundation for those conversations in a way that is currently difficult or impossible.
- 3. Providing a reference point for developing new instruments.** NZS 9420 and NZS 9421 are being developed now, alongside broader legislative and policy reform. Without a system-level reference, each new instrument risks defining its own concepts in isolation, compounding fragmentation rather than reducing it. This report gives instrument developers a reference point to test their framing against – distinguishing where new instruments need to fill genuine gaps from where they need to align with existing approaches.
- 4. Naming the moderation problem.** When risk management decisions need to be compared or aggregated within or across functions and hazards – to prioritise investment, coordinate responses to compounding or cascading risks or assess whether the system as a whole is managing risk to acceptable levels – differences in how risk has been managed need to be reconciled. This report identifies that reconciliation as a distinct and currently unresolved challenge in the New Zealand system. ISO 31000 provides a common scaffolding for assessing risk within functions and hazards, but does not itself resolve how outputs from different approaches or applications should be compared or weighted at a system level. Identifying this gap explicitly is a necessary step toward designing the moderation mechanisms the system needs.

Together, these contributions are enabling rather than prescriptive.

3 High-level system view of natural hazard risk management

3.1 ISO 31000 as an organising reference

ISO 31000 provides a useful organising reference for framing natural hazard risk management in Aotearoa New Zealand. It is a broad, adaptable standard – not a prescriptive methodology – that establishes a common set of concepts, terminology and expectations for good risk management across a wide range of contexts.

This report uses ISO 31000 not to evaluate the system as a whole against the standard, but to examine how consistently its components are reflected across the instruments, functions and hazards that make up New Zealand’s natural hazard risk management system to enable coherent decision-making.

ISO 31000 is structured around three core, interrelated components (shown in Figure 3).

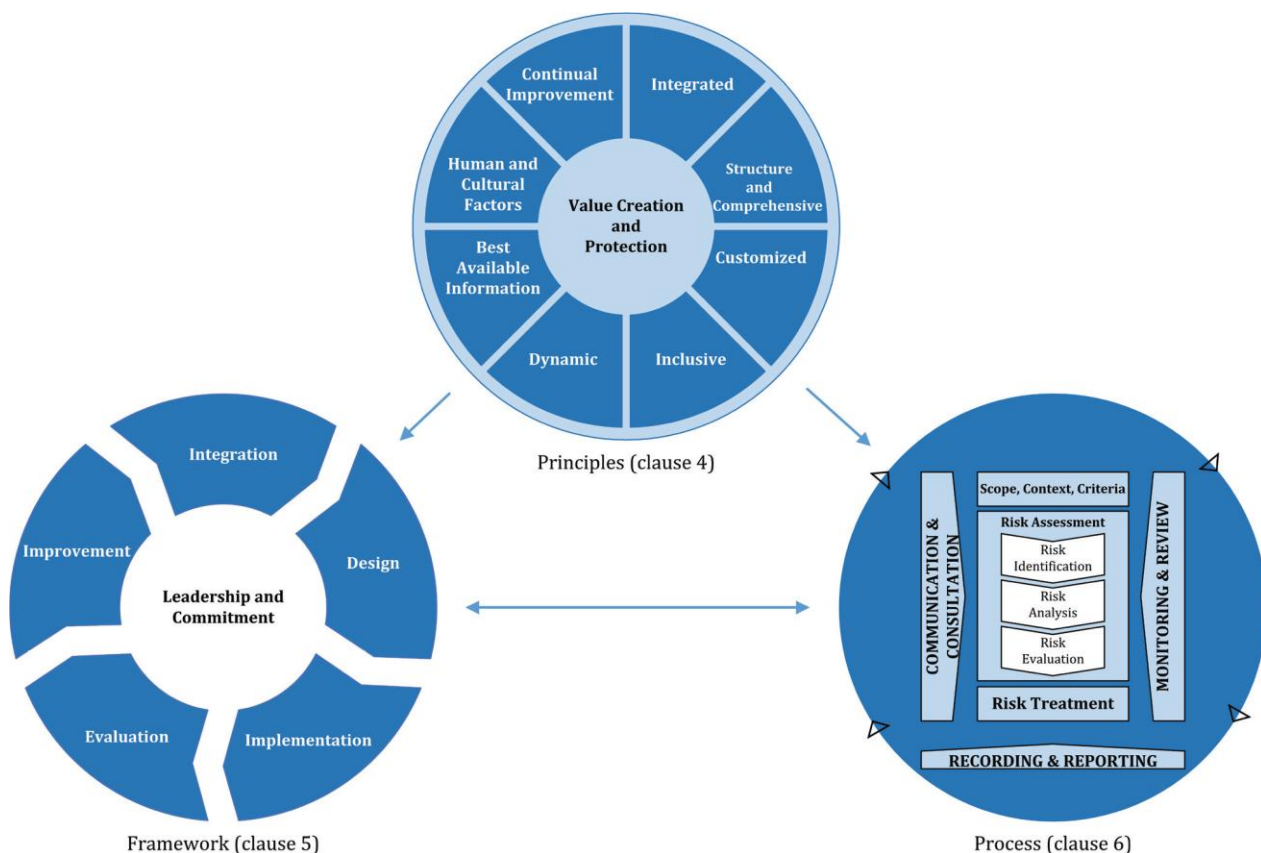


Figure 3: ISO 31000 Principles, framework and process. (ISO, 2018).

Principles describe the attributes of effective risk management. They are not requirements that every instrument or function must explicitly address; rather, they describe what good risk management looks like at a system level. The analytical question is not whether every instrument explicitly references these principles, but whether the system as a whole reflects them and where current practice falls short of doing so.

Framework describes the time-dependent lifecycle of risk management – the phases through which risk management is established, implemented, evaluated and improved within governance arrangements and decision-making processes. These phases are broadly immutable: regardless of the application context, effective risk management requires the same kind of lifecycle thinking. The analytical question is whether this lifecycle is visible and well-supported across the instruments and functions that make up the system, or whether critical phases – such as integration and improvement – are systematically weak or absent.

Process describes the actual steps involved in managing risk: communication and consultation, establishing context, risk identification, risk analysis, risk evaluation, risk treatment, and monitoring and review. Unlike the Principles and Framework, the Process is expected to be implemented differently across hazards, functions and decision contexts to reflect differences in data availability and decision requirements. The analytical question is whether that variation is appropriate and well-governed, or whether it creates unacceptable problems for system coherence.

These three components are interdependent: weak Framework governance undermines the consistency of Process implementation, which in turn affects whether Principles are reflected at the system level. Importantly, while individual instruments or functions may not need to address each element of every component explicitly, the system as a whole should reflect them all – and gaps or inconsistencies in any one component have implications for the others.

3.2 The natural hazard risk management system in Aotearoa New Zealand

Figure 4 provides a high-level conceptual view of natural hazard risk management in Aotearoa New Zealand using ISO 31000 as an organising reference. The figure is structured as a series of nested layers, with the Principles of effective risk management at the centre, surrounded by the Framework, and then the Process operating across the three example system functions considered in this report: land-use planning, infrastructure design and emergency management. The outer ring represents the range of natural hazards managed by the system.

The figure illustrates how natural hazard risk management can be viewed as a system of interconnected puzzle pieces. The Principles describe the characteristics of effective risk management, the Framework provides the governance and organisational arrangements that support it, and the Process is the mechanism through which risk is identified, analysed, evaluated and managed. These components operate across multiple functions and hazards, all within a New Zealand context shaped by Te Tiriti o Waitangi obligations and mātauranga Māori.

While the figure presents these components as a connected system, the puzzle pieces do not always fit together neatly in practice. The way the risk management Process is implemented varies across functions, organisations, regions and hazards. Some variation is appropriate and necessary, reflecting different statutory purposes, decision contexts and hazard characteristics. However, other variation creates gaps and misalignments at the joins between the pieces. Concepts are interpreted differently, terminology diverges, and approaches vary in ways that make it difficult to compare, aggregate and coordinate risk management across the system.

The quality of these joins determines the overall coherence of the system. Consistency within functions, coherence across functions, and comparability across hazards all depend on how well the outputs of the risk management Process can be understood, aligned and reconciled. Where process outputs are not readily comparable, the puzzle pieces become more difficult to connect, limiting the system's ability to understand risk consistently, manage trade-offs and support coherent decision-making.

The Framework also influences how well the pieces fit together. Even where individual risk management activities are undertaken effectively, fragmented governance arrangements, responsibilities and implementation approaches can weaken the connections between different parts of the system. As a result, effective risk management may occur within individual organisations, hazards or decision contexts without necessarily translating into effective risk management at a system level.

Viewed in this way, the Principles represent the picture the completed puzzle is intended to create. The extent to which they are reflected across the natural hazard risk management system depends on how coherently the Framework and Process operate within and across functions and hazards. Improving

coherence at these layers strengthens the connections between the puzzle pieces and increases the extent to which the Principles of effective risk management are realised at a system level.

Figure 5 complements this conceptual view by illustrating the suite of instruments that operationalise the ISO 31000 Principles, Framework and Process within the New Zealand natural hazard risk management system. Together, Figures 4 and 5 show both the conceptual architecture of the system and the legislation, policy, standards, guidance, plans and funding mechanisms through which risk management is implemented in practice.

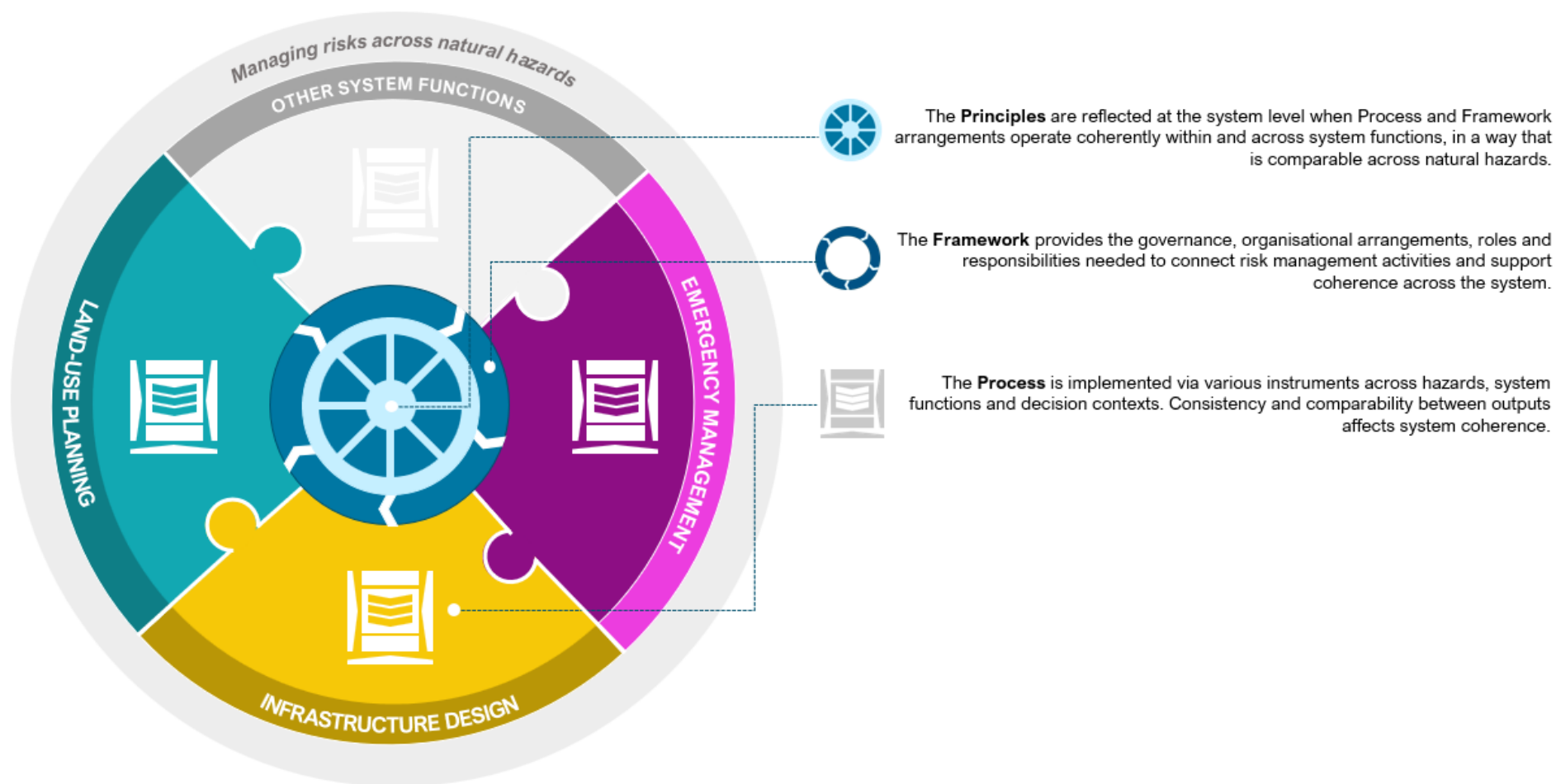


Figure 4: High-level conceptual view of natural hazard risk management in Aotearoa New Zealand. The figure uses ISO 31000 as an organising reference. The Principles represent the desired system-level attributes of effective risk management, while the Framework and Process determine how effectively the system operates in practice. The Process is illustrated through three example functions of natural hazard risk management: land-use planning (managing where and how development occurs), infrastructure design (managing risk through the design and operation of buildings and infrastructure), and emergency management (managing risk through reduction, readiness, response and recovery activities). The puzzle-piece arrangement illustrates the interconnected nature of the system and the importance of alignment within and between functions, and hazards (shown by the outermost ring), to achieve coherent risk management outcomes.

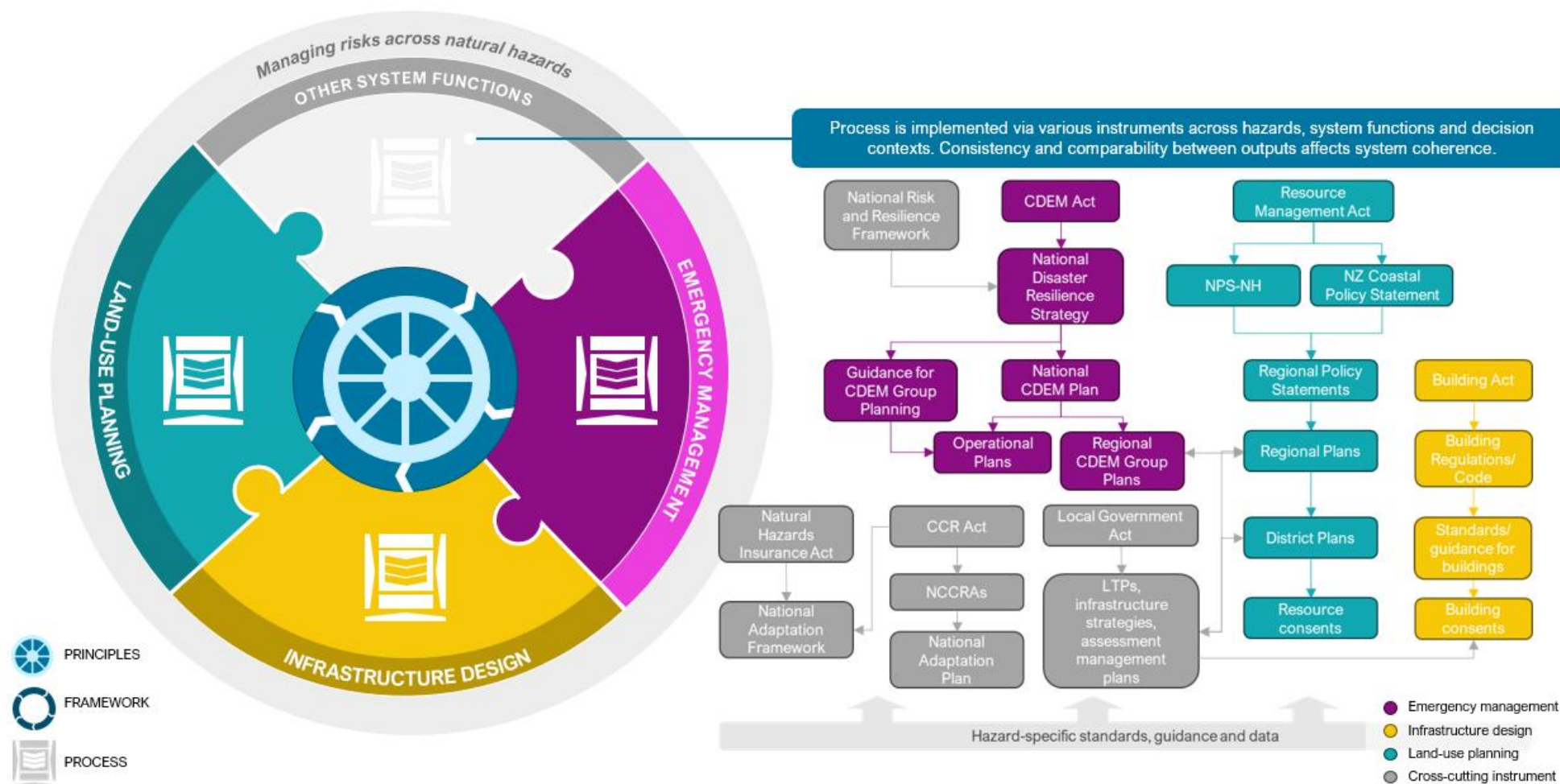


Figure 5: Instruments that operationalise the ISO 31000 Principles, Framework and Process in New Zealand. The natural hazard risk management system is implemented through an interconnected suite of legislation, policy, standards, guidance, plans and funding mechanisms. These instruments operate within and across the three example functions considered in this report – land-use planning, infrastructure design and emergency management – and collectively influence how risk is understood, assessed, managed and monitored across hazards, sectors and decision-making contexts.

4 Principles for natural hazard risk management

4.1 Overview of ISO 31000 Principles

The ISO31000 Principles describe the characteristics of effective and efficient risk management.

As summarised in Figure 6, effective risk management should be **integrated** across all organisational activities, applied in a **structured and comprehensive** way, and **customised** to the specific context in which it operates. It should draw on the **best available information**, respond **dynamically** to change, and meaningfully involve people – recognising that **human behaviour and cultural factors** shape how risk is understood and managed – with the goal of **continual improvement** over time.

At a system level, the Principles serve as a benchmark against which the natural hazard risk management system can be assessed. They do not need to be explicitly referenced in every instrument or organisation. Rather, the system as a whole should collectively reflect them. Where this does not occur, the resulting gaps point to limitations in system coherence rather than failures of individual instruments.

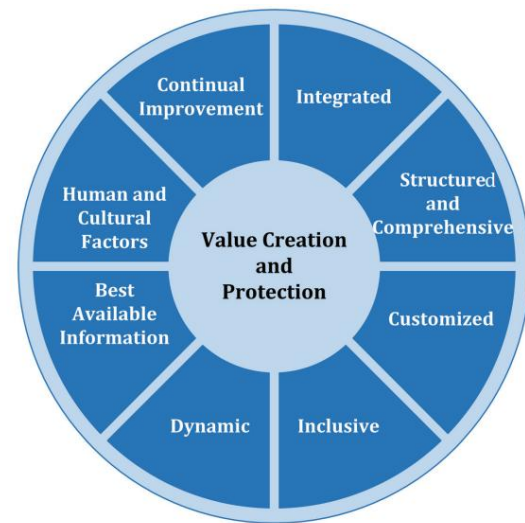


Figure 6: Principles (Source: ISO 31000: 2018)

4.2 Alignment with current practice

The ISO 31000 Principles are broadly reflected across New Zealand’s natural hazards risk management system, largely implicitly rather than explicitly.

The exceptions are the CDEM Risk Guidance (NEMA, 2022) and the NHC Risk Tolerance Methodology (NHC, 2025) which both cite ISO 31000 directly and reflect the Principles strongly in their approaches. More commonly, alignment occurs indirectly through the intent and structure of instruments rather than through direct adoption of ISO terminology or concepts.

There are no material conflicts between the Principles and existing instruments.

This largely reflects the intentionally high-level nature of the Principles, which are designed to be applied flexibly across different hazards, functions and decision contexts. Collectively, the current suite of instruments enables significant variation in how risk management frameworks and processes are designed and implemented across the system. In this respect, the principle of customisation is strongly reflected at the system level.

The primary challenge is therefore not whether the system aligns broadly with the ISO 31000 Principles, but rather the uneven and incomplete way those Principles are operationalised across different parts of New Zealand’s natural hazards risk management system.

4.3 Where variation creates challenges

Fragmented integration across system functions limits consistent management of interconnected and cascading risks.

Several integration mechanisms exist at the strategic level – the National Risk and Resilience Framework, NAP, NPS-NH and the Emergency Management Bill each seek to align effort across parts of the system – but operate in parallel rather than as a coherent whole. No single mechanism operationalises integration across

land-use planning, infrastructure design and emergency management simultaneously. The recently implemented National Adaptation Framework covers land-use planning and emergency management although is only focused on climate-related risks and is more strategic in nature than operational. This gap is most consequential at the Process level (discussed further in Section 6), where managing cascading and interconnected risks requires cross-function coordination that no shared framework currently supports (Treasury, 2018; DPMC, 2024).

Structured approaches exist within many parts of the system, but the absence of a sufficiently shared structure across hazards and system functions reduces consistency and comparability in how risks are managed.

Individual instruments apply structured approaches to risk management within their own domains, but the system as a whole is not structured and comprehensive in the ISO sense. Risk management concepts, terminology and process steps vary across instruments in ways that are not always justified by hazard or decision context. Comparable risks may therefore be assessed and managed differently depending on which instrument, function or region applies – not because variation is necessarily required, but because no common structure exists to connect them.

Uneven application of dynamic and adaptive approaches creates tension between long-term risk governance and shorter-term operational systems.

Dynamic risk management is most explicitly reflected in climate-sensitive hazards reflecting the changing and uncertain nature of future hazard risk. The NCCRA (2026), NPS-NH, NZ Coastal Guidance and NZCPS address the influence of climate change on hazard profiles through scenario-based framing and long planning horizons. The cadence of review cycles for these strategic instruments under the CCR Act also reflect the dynamic and evolving nature of climate science and best available data. However, many planning, infrastructure and funding systems continue to rely on relatively static assumptions, fixed thresholds and shorter-term decision cycles. This creates inconsistency between long-term adaptation objectives and operational decision-making, increasing the risk of lock-in and maladaptation over time (DPMC & MfE, 2025).

Inconsistent treatment of evidence (best available information), uncertainty and mātauranga Māori affects coherence in how risk is understood across the system.

The maturity of hazard datasets, modelling capability and technical guidance varies significantly across hazards and sectors. Flooding, coastal hazards and seismic engineering are generally supported by comparatively mature guidance and analytical methods, whereas other hazards, such as avalanches and severe weather, rely more heavily on practitioner judgement, fragmented datasets or emerging science. Even where modelling capability is well developed (for example, for flood hazards), differences in assumptions, methodologies, and scenarios create inconsistencies across regions, making national-scale risk assessment and planning challenging. For instance, a national asset owner may need to work with multiple regional flood datasets that differ in spatial resolution, modelling approaches, and treatment of future climate scenarios.

A further source of inconsistency is the treatment of mātauranga Māori. Mātauranga relating to the behaviour of maunga, awa, repo, coastal dynamics, soils and wind patterns reflects long-horizon observational knowledge (800+ years) directly relevant to hazard identification and risk analysis. However, while several instruments acknowledge the importance of mātauranga strategically¹, operational practice still tends to treat it primarily as a consultation or cultural consideration rather than substantive technical knowledge informing the evidence base itself. Related issues of Māori data sovereignty and rangatiratanga are also reflected

¹ For example, NEMA (2022) notes that any comprehensive risk assessment process in New Zealand needs to include Māori worldviews and the concepts of taonga.

inconsistently across instruments and functions. Together, these differences create inconsistency in what counts as evidence across the natural hazards risk management system.

Community and cultural perspectives are reflected more strongly in consultation processes than in substantive risk evaluation and decision-making.

Participation and engagement requirements are well established across the RMA, CDEM Act, LGA and Emergency Management Bill, and several instruments explicitly acknowledge Māori perspectives and community values (NEMA, 2022). However, operationalisation tends to remain process focused. Human and cultural perspectives are less consistently reflected in how acceptable risk is defined, how trade-offs are evaluated, and how long-term wellbeing is incorporated into technical decision-making processes. *Building Resilience to Hazards* (DPMC & MfE, 2025), for example, acknowledges that Māori perspectives on whenua and collective wellbeing may lead to different risk priorities, but this remains a strategic observation rather than an operational commitment.

A more substantive gap is the limited integration of whakapapa-based understandings of risk into broader system practice. Whakapapa frames hazard risk as place-based, relational and intergenerational – shaped through ongoing relationships between people, land and water rather than discrete hazard events assessed in isolation. This sits uneasily alongside the fragmented, static and hazard-specific approaches that characterise much of the current system, while aligning more closely with the whole-of-catchment and long-term perspectives reflected in the integrated and dynamic principles. Addressing this gap would require not only stronger engagement processes, but broader consideration of what counts as evidence and whose knowledge informs risk characterisation and decision-making across the system.

Fragmented learning and inconsistent implementation of lessons reduces the system's ability to improve proactively over time.

Mechanisms for continual improvement exist across the system, such as plan review cycles under the RMA, LGA and CDEM Act, post-event reviews in emergency management, and the iterative NCCRA/NAP cycle under the CCR Act. The continual improvement principle is therefore reflected, but the quality of its reflection is uneven. Improvement tends to be reactive and event-driven rather than systematic and proactive. The NISWE Inquiry (DIA, 2024) found lessons from previous events had not been consistently embedded, and the Government acknowledged many findings were not new – raised in prior inquiries but not acted upon (New Zealand Government, 2024). The gap is not the absence of improvement mechanisms but the absence of systematic, cross-function learning that embeds lessons before the next event.

4.4 What this means: implications and discussion questions

The primary implication of the challenges identified in relation to the Principles is not that the system lacks alignment with ISO 31000, but that key Principles are operationalised unevenly across functions, organisations and hazards.

This limits coordinated management of interconnected risks, contributes to inconsistent practice, and makes it more difficult to distinguish between justified and unjustified variation in risk management approaches. The key system-level implications are summarised in Table 1.

Table 1: Implications of the Principles analysis for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Fragmented integration and uneven application of dynamic approaches make it difficult to coordinate management of interconnected and cascading risks across land use planning, infrastructure design and emergency management.
Consistency within functions	Differences in how evidence, uncertainty, community perspectives and continual improvement are applied contribute to variable practice across organisations, regions and decision contexts.
Comparability across hazards	Variability in evidence maturity, analytical approaches and treatment of uncertainty makes it difficult to understand whether differences in risk management between hazards are justified and appropriate.

These implications raise several areas for consideration in the future framing of the natural hazard risk management system.

What level of cross-functional integration is required?

Current instruments support coordination across parts of the system, but provide limited direction on how land-use planning, infrastructure design and emergency management should operate together in practice. Should future framing establish stronger expectations or mechanisms for integrated management of cascading and interconnected risks?

Is a clearer system-wide structure needed?

Differences in terminology, methodologies and process expectations can limit comparability across hazards and functions. Should future instruments establish a more consistent set of system-level concepts, risk management expectations or terminology to connect existing approaches more effectively?

How should future uncertainty be reflected in risk management?

Dynamic approaches are relatively well developed in climate adaptation contexts, but less consistently embedded elsewhere. Should future framing include clearer expectations around review cycles, triggers, adaptive pathways and treatment of long-term uncertainty across the broader natural hazard risk management system?

What should count as evidence in natural hazard risk management?

The system currently applies differing assumptions about evidence, uncertainty and knowledge. Future work may need to consider whether clearer expectations and guidance are needed regarding minimum evidence standards, treatment of uncertainty, and how mātauranga Māori and Māori data sovereignty are recognised operationally at the system-level.

How should community, cultural and intergenerational perspectives influence decision-making?

Community and cultural perspectives are currently reflected more strongly in consultation processes than in technical risk evaluation. Should future instruments provide clearer direction on how community values, Te Tiriti obligations, intergenerational wellbeing and place-based understandings of risk are incorporated into definitions of acceptable risk and decision-making processes? This is partially addressed in the NHC Risk Tolerance Methodology (NHC, 2025).

How should continual improvement occur across the system?

Persistent findings across major reviews and inquiries raise questions about whether stronger cross-system learning mechanisms are needed. Would a formal 'Lessons Management System' or similar mechanism improve the system's ability to embed lessons consistently across organisations and functions?

5 Framework for natural hazard risk management

5.1 Overview of ISO 31000 Framework

The ISO 31000 Framework describes how risk management is embedded within governance arrangements, organisational structures, decision-making and operational practice over time. It is the institutional architecture needed to support operationalisation of the Process into time-dependent activities within and across organisations.

The Framework comprises six interrelated elements (shown in Figure 7): leadership and commitment (a necessary prerequisite); integration; design; implementation; evaluation; and improvement.



Figure 7: ISO 31000 Framework (Source: ISO 31000: 2018)

5.2 Current alignment in practice

Within individual functions, relatively coherent framework arrangements exist.

Infrastructure design has the strongest organisational coherence for selected hazards, particularly seismic risk. The Building Act, Building Code and AS/NZS 1170 standards establish nationally consistent governance, compliance and assurance pathways for seismic risk management. Clear accountabilities exist between designers, building consent authorities and regulators, supported by mandatory standards and formal compliance mechanisms. This creates relatively high consistency within the infrastructure design function for hazards where mature national standards exist.

Emergency management also demonstrates relatively mature framework structures, underpinned by the CDEM Act, which establishes governance across national, regional and local levels through the 4Rs model and CDEM Group structures. Supporting guidance (e.g. CDEM Risk Guidance provides a shared organisational approach for CDEM Groups, while the National Risk and Resilience Framework strengthens national-level coordination of crises through the risk-coordinating agency model.

Land-use planning has historically operated with weaker national framework coherence because the RMA enabled substantial local discretion in how councils structured natural hazard risk management. The NPS-NH and its Implementation Guide are the most significant recent attempts to strengthen consistency in governance expectations and decision-making structures across councils.

Several cross-system instruments attempt to improve framework coherence across organisations and sectors.

The CCR Act, together with the NCCRAs, NAP and National Adaptation Framework, collectively establishes an iterative governance cycle for climate adaptation, resulting in comparatively stronger coherence for climate-related risks than for natural hazards more broadly. Within this suite, the National Adaptation Framework is particularly significant because it explicitly addresses system-level roles, investment and coordination across functions (land-use planning and emergency management). In parallel, the National Risk and Resilience Framework provides the clearest national strategic governance structure spanning multiple hazards and sectors, including designated risk-coordinating agencies and mechanisms for cross-government engagement. However, the influence of these instruments is strongest at the strategic level, with more limited translation into operational alignment across existing frameworks.

5.3 Where variation creates challenges

Fragmented governance arrangements across functions limit coordinated management of natural hazard risk across the system.

The dominant challenge for framework coherence in New Zealand is that risk management frameworks have evolved separately within different functions, organisations and hazard domains, with limited mechanisms to align governance, accountability, capability or implementation across the broader system.

The planning, infrastructure and emergency management systems were developed under different legislation, ministries and operational objectives. As a result, they operate through different governance arrangements, accountability structures and implementation cycles.

For example:

- land-use planning operates primarily through local authority planning and consenting processes under the RMA;
- infrastructure design operates through national building regulation, engineering standards and asset-owner responsibilities;
- emergency management operates through CDEM Group structures coordinated nationally by NEMA.

No overarching framework consistently aligns these systems operationally.

This fragmentation creates practical governance problems. A council may restrict development under the NPS-NH based on long-term hazard risk, while infrastructure providers continue designing assets under separate engineering frameworks and emergency management agencies plan using different regional consequence frameworks. In many cases, these differences are appropriate, reflecting different objectives, statutory mandates, decision timeframes and risk tolerances. For example, emergency management often adopts a more conservative approach focused on life safety, while land-use planning must balance risk reduction with broader considerations such as property rights, development needs and community outcomes.

The challenge is not that these approaches differ, but that the assumptions, objectives and trade-offs underpinning those differences are not always explicit or readily reconciled across functions. As a result, the same community may be managed through multiple parallel risk governance structures that are only loosely connected, making it difficult to align decisions, understand cumulative outcomes, and manage interconnected risks consistently across the system.

Cross-system frameworks partially improve alignment but also expose coherence pressures arising from temporal and funding misalignment across the system.

Instruments such as the National Adaptation Framework, NCCRA and the NZCPS adopt long-term, dynamic approaches to managing climate-related risks and explicitly span multiple system functions, while the National Risk and Resilience Framework provides strategic, cross-hazard governance and coordination at a national level. However, these operate alongside shorter-term planning, infrastructure investment and funding cycles (e.g. LTPs and project-based funding), which are not designed to support multi-decadal risk management or adaptive pathways. As a result, long-term strategic intent is not consistently translated into coordinated implementation, creating structural tension between adaptive, system-level governance and shorter-term operational and investment decision-making, and limiting the ability to sequence, fund and sustain coherent risk management responses over time.

Variation in organisational capability contributes to coherence challenges where it results in inconsistent implementation of otherwise shared frameworks.

Within land-use planning, councils continue to apply materially different governance and implementation approaches despite operating under the same legislative framework. Under the RMA and LGA, there were

historically no minimum requirements organisational capability, framework maturity, risk governance structures or natural hazard risk management processes. As a result, implementation quality has varied considerably between councils depending on resourcing, expertise, political priorities and access to specialist information.

The NPS-NH seeks to improve consistency within the planning function by establishing stronger national direction. However, implementation still depends heavily on local capability and institutional capacity. Smaller councils often rely on external consultants and fragmented datasets, while larger councils generally maintain more mature in-house hazard and planning capability. This creates uneven framework maturity nationally even where policy direction is nominally consistent.

Within emergency management, the governance and organisational arrangements established under the CDEM Act provide clearer national structures, but implementation capability remains uneven across the sixteen CDEM Groups. The NISWE Inquiry (DIA, 2024) identified major variation in leadership, coordination, resourcing and operational capability during the 2023 severe weather events (DPMC & MfE, 2025). The Emergency Management Bill seeks to address some of these weaknesses through clearer accountability and minimum standards, indicating that current framework arrangements have not delivered consistent capability nationally.

Within infrastructure design, organisational coherence is comparatively strong because nationally regulated standards and compliance pathways improve the consistency of implementation expectations for certain hazards. However, this coherence is strongest within the structural engineering domain itself rather than across broader natural hazard risk management functions. Hazard areas with less mature national guidance – such as wildfire resilience or cascading infrastructure failure – remain less consistently embedded within organisational governance frameworks.

In itself, this variation is not inherently problematic in a system that allows for context-specific application. However, in the absence of sufficiently strong shared frameworks and minimum expectations for implementation, these differences result in materially different outcomes in practice, with similar risks managed inconsistently across regions and organisations. This limits consistency within functions, undermines alignment across functions, and constrains the ability to compare and coordinate risk management decisions at a system level.

Cross-hazard governance arrangements are unevenly developed across the system.

Framework coherence is often strongest where mature, hazard-specific governance and standards exist (for example, seismic risk within infrastructure design or coastal hazards within planning and adaptation frameworks). However, this coherence is not replicated consistently across all hazards. Many hazards rely on fragmented, sector-specific or emerging frameworks with limited integration across functions. For example, space weather risk remains largely governed through emergency response arrangements via the National Space Weather Response Plan, rather than through integrated planning or infrastructure governance mechanisms. This creates uneven governance coverage across hazards and undermines the ability to manage multi-hazard and cascading risks coherently.

There is no clearly defined system-level framework architecture or stewardship for overall coherence.

Cross-organisational fragmentation is also reinforced institutionally. Responsibilities are distributed across DPMC, NEMA, MfE, MBIE, NHC, local government, lifeline utilities and infrastructure operators, but no single organisation has clear responsibility for overall natural hazard risk management system coherence.

The National Risk and Resilience Framework provides the strongest coordination mechanism at the national level, but does not prescribe how operational risk management frameworks should align across functions, leaving gaps in how governance responsibilities are coordinated, how risk is defined and used to inform decisions, and how implementation is aligned in practice. The LGA partially addresses these gaps at the

operational level, through long-term plans and asset management planning. However, varying council capability, funding constraints and uneven access to specialist expertise continue to produce highly variable implementation nationally.

5.4 What this means: implications and discussion questions

At a system level, the primary coherence challenge is that frameworks have evolved separately across functions and hazards without a shared architecture to align them.

This creates fragmentation both within functions (for example, between councils or CDEM Groups) and across functions (for example, between planning and infrastructure design), limiting the ability to coordinate risk management decisions across the system. As a result, decisions made within individual frameworks do not reliably align or aggregate into coherent system-level outcomes. The key system-level implications arising from the challenges identified in relation to the Framework are summarised below.

Table 2: Implications of the Framework analysis for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Separate governance arrangements, planning cycles and accountability structures limit the ability to coordinate risk management across land-use planning, infrastructure design and emergency management. Decisions affecting the same communities may therefore not be aligned or mutually reinforcing.
Consistency within functions	Variation in organisational capability, resources and framework maturity contributes to different implementation outcomes across councils, CDEM Groups and other organisations, even where the same legislative or policy frameworks apply.
Comparability across hazards	Governance arrangements and supporting frameworks are more mature for some hazards than others, making it difficult to establish a consistent understanding of risk management expectations across hazards and to coordinate responses to multi-hazard and cascading risks.

Several strategic questions emerge from this:

Should stronger cross-functional governance arrangements be established?

Land-use planning, infrastructure design and emergency management continue to operate largely through parallel governance systems. Should future framing establish clearer mechanisms for aligning these functions operationally where risks, responsibilities and decision-making intersect across the system?

Who is responsible for system-level coherence?

Responsibilities for natural hazard risk management are currently distributed across multiple agencies, organisations and infrastructure operators. Is a clearer stewardship, oversight or coordination role needed at the system level to improve alignment across governance arrangements and implementation pathways?

Should minimum organisational capability expectations be established?

Variation in organisational capability results in uneven implementation of otherwise shared frameworks. Should minimum expectations for capability, risk governance maturity and access to information be defined to support more consistent system performance? Notably, the NAP and National Adaptation Framework both seek to improve information sharing for climate-related natural hazards.

How should long-term adaptation governance interact with existing operational systems?

Adaptation frameworks introduce long-term approaches (often dynamic) to risk management, but operate alongside shorter-term planning and funding cycles. How can these be better aligned to support consistent, coordinated decision-making over time, noting that this may be partially addressed via the Emergency Management Investment and Implementation Roadmap (MfE, 2025)?

How should continual improvement occur across the framework level?

Repeated findings across major inquiries suggest lessons are not consistently embedded across organisations and functions. Would stronger cross-system evaluation, assurance or lessons-management mechanisms improve continual improvement across the broader natural hazard risk management system? What would an integrated Monitoring, Evaluation and Learning (MEL) framework look like for the natural hazard risk management system?

6 Process for natural hazard risk management

6.1 Overview of ISO 31000 Process

The ISO 31000 Process provides a structured approach to managing risk across six interrelated activities shown in Figure 8.

The Process is iterative, not linear. It is a cycle revisited as risk profiles change, new information becomes available, treatments are implemented, and monitoring reveals new insights. Communication and consultation, and monitoring and review run continuously across all other steps rather than occurring at discrete points.

Unlike the Principles and Framework, which operate primarily at organisational and governance levels, the ISO 31000 Process is operational. It may be applied at multiple scales, from site-specific hazard assessments and infrastructure design through to regional planning decisions and national risk assessment. It is also applied across a wide range of natural hazards with differing characteristics, timeframes, levels of uncertainty and decision contexts.

The sections below assess each Process step in turn. The analytical question is not whether every instrument implements the steps identically, but whether variation in how steps are approached across hazards, functions and decision contexts is appropriate and well-governed – or creates unacceptable problems for system coherence.

6.2 Communication and consultation

Communication and consultation under ISO 31000 is a continuous activity, not a discrete step. It involves engaging with relevant stakeholders throughout all stages of the risk management process, from establishing scope and criteria through to treatment, monitoring and review.

In the New Zealand context, relevant participants include decision-makers and technical specialists across all levels of government, communities and community groups, implementing agencies, emergency services, and mana whenua.

6.2.1 Alignment with current practice

Communication and consultation are widely recognised across the system as integral to effective natural hazard risk management, rather than as purely procedural or compliance activities.

The CDEM Act embeds community participation as a core principle of emergency management, while CDEM Risk Guidance explicitly integrates engagement with communities, iwi and key stakeholders throughout the risk management process in close alignment with ISO 31000. The Emergency Management Bill proposes stronger requirements for community and iwi Māori participation in emergency management planning and decision-making, reflecting lessons from the NISWE Inquiry regarding trust, coordination and public engagement during the 2023 severe weather events (DIA, 2024).

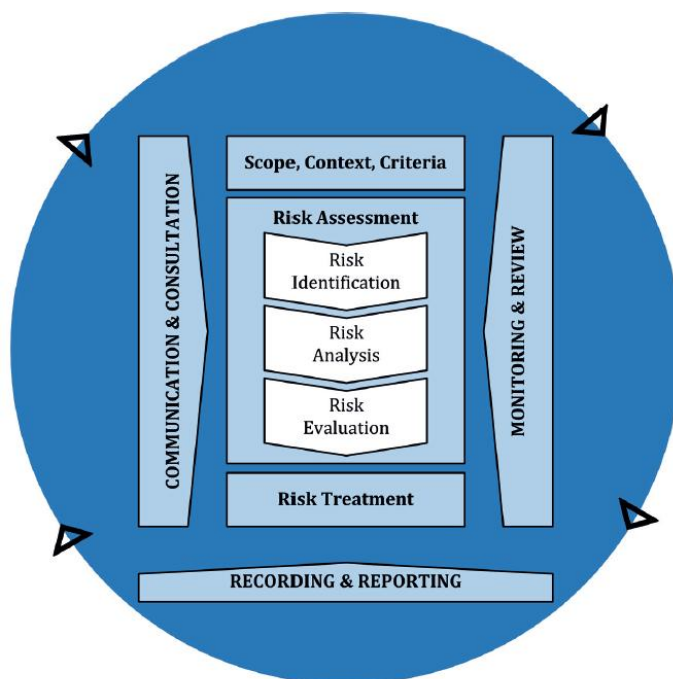


Figure 8: ISO 31000 Process (Source: ISO 31000: 2018)

Within land-use planning, the RMA and associated plan-making processes provide for a process of public notification, submissions and hearings for planning decisions – including those where a consideration of natural hazards is required. The NPS-NH supports a risk-based approach to natural hazard decision-making but does not itself establish additional engagement requirements, relying instead on existing planning processes to facilitate community input.

Hazard-specific guidance and standards show more variable alignment with this process step. Some instruments explicitly incorporate communication and consultation as part of risk management—for example:

- AGS Guidelines embed stakeholder consultation in defining risk acceptance and tolerance for landslide risk management
- NZ Coastal Guidance includes community engagement for adaptive pathways decision-making.

In operational hazard contexts, communication may be strong but narrowly focused. Instruments such as fire danger ratings, volcanic alert levels and tsunami warning systems provide clear public-facing communication during response phases, but are not typically embedded within broader consultation or deliberative processes about risk management decisions.

More broadly, asset owners are generally not required to engage with communities as part of their risk identification and management processes. This creates a gap between those who assess and manage risk and those who are exposed to it.

An important exception is emerging in the climate domain. Through Financial Markets Authority (FMA) climate-related disclosure requirements, certain organisations are required to identify, assess, and disclose their climate-related risks and how they are managed. In effect, this introduces a form of risk communication – primarily to investors and financial stakeholders – intended to improve transparency and decision-making. However, this requirement applies only to a limited subset of organisations and is not designed as a substitute for broader community engagement on risk.

6.2.2 Where variation creates challenges

Engagement is often limited within technical risk assessment processes, rather than consistently embedded in framing risk.

While statutory processes under instruments such as the RMA provide opportunities for consultation and engagement, particularly during plan-making and consenting, participation is less consistently embedded in upstream technical processes such as hazard modelling and risk analysis. These activities are typically treated as expert-led exercises, with limited incorporation of community knowledge, mātauranga Māori, or lived experience in shaping assumptions, validating outputs, or defining risk parameters.

This pattern is reinforced by hazard-specific guidance, where technical assessment is typically undertaken prior to engagement. Engineering, geotechnical and modelling guidance – such as flood modelling, slope stability and structural design standards – generally treat analysis as an expert-led process, with communication occurring downstream through planning or regulatory processes rather than being embedded within the assessment itself. Even where hazard-specific guidance includes engagement (e.g. AGS Guidance or NZ Coastal Guidance), this is not consistently integrated across other hazards or aligned with function-specific decision frameworks.

Risk communication is inconsistent in content and quality across the system.

Recent changes requiring councils to include all known hazard information on Land Information Memoranda (LIMs) have increased transparency of hazard information, but also highlight inconsistency in how risk is communicated. In many cases, information is limited to hazard identification (e.g. presence of flooding or instability), with little explanation of what the risk means (analysis) or what actions could be taken to manage it (treatment). As a result, communication can be incomplete or difficult to interpret.

This inconsistency can lead to communities being overwhelmed by information, confused by differing messages, or losing confidence in risk information – particularly where it does not align with lived experience. It also reinforces a disconnect between technical risk assessment outputs and how risk is understood and acted upon by communities.

Willingness and incentives to communicate risk transparently also vary across the system.

In several contexts, communication may be shaped by institutional incentives to manage uncertainty, maintain public confidence or avoid reputational or financial consequences. This can result in partial, simplified or delayed communication of risk, particularly where uncertainty is high or decisions are contested. These dynamics are rarely addressed explicitly within instruments, but influence how risk information is presented in practice.

Te Tiriti obligations and mātauranga Māori are reflected inconsistently across communication and consultation processes.

The CDEM Risk Guidance treats mātauranga Māori as substantive technical knowledge rather than a values consideration to be managed through a separate engagement process. Most other instruments either omit this dimension entirely or address it in generic terms, producing inconsistency in how Te Tiriti obligations are given effect across hazards and functions.

These patterns matter most for establishing risk context, criteria and tolerability.

Risk tolerance thresholds that are set without meaningful community participation are less likely to hold up over time, particularly when decisions based on those thresholds affect communities directly. This approach limits trust, reduces legitimacy, and contributes to misalignment between technical assessments and community expectations (DPMC & MfE, 2025).

6.2.3 What does this mean: implications and discussion questions

Communication and consultation are not consistently integrated into how risk is framed, analysed and understood. As a result, similar risks may be interpreted differently across functions, organisations and communities, reducing transparency, trust and the ability to align decisions across the system.

The challenges identified above are less about whether communication occurs, and more about when, how and for what purpose it occurs. Communication often follows technical assessment rather than informing it, meaning community knowledge, mātauranga Māori and lived experience are not consistently reflected in the assumptions, parameters and risk tolerances that shape decision-making. At the same time, differences in the quality, content and transparency of risk communication can result in different understandings of the same underlying risk.

The key system-level implications arising from the communication and consultation analysis are summarised below.

Table 3: Implications for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Separation between technical risk assessment and engagement processes can result in planning, infrastructure design and emergency management developing different understandings of the same underlying risk and different assumptions about acceptable risk.
Consistency within functions	Variation in the timing, quality, transparency and extent of engagement contributes to differing assumptions, priorities and

Dimension	Key implication
	levels of stakeholder influence across organisations, regions and decision contexts.
Comparability across hazards	Differences in how risks, uncertainty and trade-offs are framed and communicated make it difficult for communities, decision-makers and practitioners to interpret and compare risks consistently across hazards.

Key considerations for future framing of the natural hazard risk management system include:

At what stage of the Process should communities participate?

Should greater emphasis be placed on embedding engagement within technical risk assessment, particularly in shaping assumptions and validating outputs?

How should risk be communicated in a way that is consistent, interpretable and actionable?

Is there a need for clearer expectations around communicating hazard, risk, uncertainty and management options (for example, in tools such as LIMs)? Should a common set of terms be defined (i.e to cover hazard, exposure, risk etc) to avoid confusion when consulting and engaging on risk?

How should Te Tiriti obligations be operationalised consistently across the system?

Should future instruments provide clearer direction on the role of mātauranga Māori within risk framing and assessment, rather than primarily within consultation processes?

What level of consistency in engagement and communication is needed?

Should minimum expectations be established to ensure that variation reflects context rather than differences in process or transparency? Where risk information is uncertain, contested or consequential, should future instruments establish clearer expectations regarding disclosure of assumptions, uncertainty, limitations and trade-offs?

6.3 Scope, context, criteria

This step sets the foundation for everything that follows. It defines the objectives and parameters of the risk management process, establishes the risk criteria – likelihood and consequence definitions, risk matrices, tolerance thresholds – and determines how compounding and cascading risks will be considered. Decisions made at this point carry through to risk identification, analysis, evaluation and treatment. Incompatibilities introduced here are difficult to resolve later.

6.3.1 Alignment with current practice

National-level frameworks and hazard-specific guidance broadly recognise the need to establish scope and context before undertaking risk assessment – and several documents provide structured mechanisms for doing so.

At a system level, national frameworks establish broad context rather than detailed criteria. The National Risk and Resilience Framework defines natural hazards as national risks within a wider system of 28 identified risks, providing a shared strategic context but not specifying risk criteria or tolerability thresholds. While this absence allows flexibility at local and community scales, it highlights an opportunity to consider whether clearer articulation of risk criteria and thresholds at the national level could support greater consistency and comparability across the system. Similarly, the National Disaster Resilience Strategy articulates national objectives and community values that inform risk context across emergency management. The NCCRA and

NAP clearly articulate the approach and decisions for assessment boundaries, value domains, time horizons, and assessment criteria.

At regional and operational levels, context-setting becomes more explicit. The CDEM Act requires CDEM Groups to identify hazards and assess risks within their regions (geographic scope), while CDEM Risk Guidance provides the clearest ISO 31000-aligned structure for defining local scope, scale, likelihood and consequence criteria, including consistent risk matrices and consideration of vulnerability and exposure.

Within land-use planning, the NPS-NH introduces a nationally consistent risk matrix, requiring councils to define risk levels (very high to low) and link these to avoidance or proportionate management decisions. The NHC Risk Tolerance Methodology represents the most explicit attempt to establish consistent national approaches to tolerability, including thresholds for acceptable, tolerable and intolerable risk, although its application remains voluntary.

At the same time, hazard-specific standards and guidance establish structured criteria within their own domains, often with greater specificity than system-level frameworks:

- NZS 1170.5 defines probabilistic seismic design criteria based on annual probability of exceedance and structural performance requirements.
- AGS Guidelines define quantitative individual and societal risk thresholds (including fatality risk) using an ALARP framework.
- NZ Coastal Guidance applies long-term, scenario-based contexts (e.g. sea-level rise over ≥ 100 years) rather than fixed probabilistic thresholds.
- National flood guidance requires definition of acceptable levels of service and flood risk tolerability (MfE, 2010).

6.3.2 Where variation creates challenges

Variation in how risk context, criteria and tolerability are defined does not inherently limit system coherence; in several cases it reflects necessary differences in purpose, scale and hazard characteristics.

Across the system, different instruments express risk criteria in a range of forms, including quantitative life-safety thresholds (e.g. landslide guidance, seismic standards), qualitative likelihood–consequence matrices (e.g. NPS-NH, CDEM Risk Guidance), probabilistic structural performance measures (e.g. Building Code), and scenario-based approaches for long-term or uncertain risks (e.g. NZ Coastal Guidance).

These differences are often appropriate and reflect the diversity of decision contexts the system must address.

- **Different objectives:** Life-safety thresholds and level-of-service standards are designed to answer fundamentally different questions. Instruments such as the Building Code and AGS Guidance appropriately use probabilistic life-safety thresholds, while infrastructure planning frameworks define acceptable levels of service based on asset performance and continuity.
- **Different scales of decision-making:** National frameworks appropriately establish broad risk context without prescribing detailed tolerability thresholds, leaving scope for regional and local variation that reflects differing hazard profiles, exposure, values and community priorities. However, a clearer national understanding of risk tolerability (for example, in relation to potential impacts on GDP or other system-level outcomes) could enable aggregation and encourage more system-level coherence in risk management.
- **Different hazard characteristics:** Some variation reflects inherent differences in how hazards behave and are assessed. Wildfire risk criteria, for example, are necessarily dynamic (set through the New Zealand Fire Danger Rating System based on current weather conditions), while space weather criteria

are appropriately framed around scenario-based infrastructure response through the National Space Weather Response Plan.

In this sense, variation is a necessary feature of a multi-hazard, multi-function system rather than a flaw.

Some variation is already being partially mediated.

The NPS-NH risk matrix provides the most explicit example within land-use planning, offering a common decision framework that brings together inputs from multiple hazard domains into a shared set of qualitative categories (very high to low risk). In practice, this functions as a translation layer, requiring hazard-specific outputs (e.g. flood modelling, geotechnical assessments, seismic information) to be interpreted within a common structure for planning decisions. CDEM Risk Guidance provides a coherent moderation layer to accommodate different risk criteria at the operational level.

The NHC Risk Tolerance Methodology similarly introduces more consistent concepts of tolerability—particularly for life-safety risk—that are intended to apply across hazards and functions. In principle, this provides a broader basis for relating different types of criteria, although its application remains voluntary and uneven.

Variation becomes a coherence challenge where there is no effective mechanism to moderate or translate between different approaches to risk criteria.

Where translation mechanisms are partial or absent:

- Likelihood and consequence cannot be consistently reconciled across frameworks. Different instruments define likelihood (e.g. probabilistic return periods, qualitative categories, or scenarios) and consequence (e.g. life safety, asset performance, or multi-domain impacts) in fundamentally different ways (or indirectly via exposure and vulnerability framing), with no agreed method for relating them within a common decision framework.
- Practitioners must rely on implicit or ad hoc judgement to interpret and combine inputs.
- The same level of underlying risk may be framed differently across instruments, or decision contexts. Where likelihood and consequence are constructed differently, equivalent risks may be categorised or prioritised differently depending on the framework used, even for the same place and hazard.

These challenges are most evident at the interfaces between functions, rather than within individual instruments. While frameworks such as the NPS-NH create coherence within land-use planning, there is no equivalent, system-wide framework that aligns planning, infrastructure design and emergency management approaches.

A distinct coherence gap arises from the absence of risk criteria for cascading and systemic risks.

Across the system, risk criteria are generally defined for individual risks within bounded domains – for example, risk to life safety from building collapse, risk to assets from flooding, or disruption to services from specific hazard events. Even where multiple hazards are considered, they are typically assessed as separate risks, each with its own criteria and thresholds.

NCCRA (2026) highlights that many of the most significant risks arise not from individual hazards, but from interacting and cascading impacts across systems – for example, where infrastructure failure triggers disruption to essential services, which in turn affects communities, economic activity and emergency response capability. These risks are systemic, cross-sector and dynamic, often unfolding over time and across organisational boundaries. However, current frameworks do not define what constitutes acceptable or tolerable levels of these cascading or system-level risks. While interdependencies may be recognised qualitatively in national or strategic assessments, this is not translated into operational criteria that can guide decision-making across planning, infrastructure and emergency management functions.

6.3.3 What this means: implications and discussion questions

Variation in scope, context and criteria only constrains coherence where it affects the ability to align decisions across the system to appropriately manage risk. Where differences are structured and mediated, they can be accommodated without issue.

The coherence challenge arises at the interfaces between instruments. Different ways of defining and bounding risk – across planning, infrastructure and emergency management – must be reconciled in practice without clear rules. This creates reliance on implicit judgement and makes it difficult to ensure that decisions affecting the same communities are aligned. A second issue is uneven specification. Where some risks have clear criteria and others do not, it becomes unclear whether differences in outcomes reflect deliberate choices or gaps in how risk has been framed.

The key system-level implications arising from the challenges identified in relation to scope, context and criteria are summarised in Table 4.

Table 4: Implications for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Different definitions of risk, tolerability and decision criteria make it difficult to align decisions across land-use planning, infrastructure design and emergency management, particularly where multiple functions are managing the same underlying risk.
Consistency within functions	Variation in how risk criteria are defined and applied can result in similar risks being framed and evaluated differently across regions, organisations and decision contexts.
Comparability across hazards	Differences in likelihood measures, consequence frameworks, tolerability thresholds and assessment boundaries limit the ability to compare risks across hazards and understand their relative significance at a system level.

This raises questions that future framing of the natural hazard risk management system will need to engage with directly.

Is a common risk criteria translation framework achievable across land-use planning, infrastructure design and emergency management (i.e. extending the CDEM Risk Guidance) – and if not, what minimum shared reference would allow decisions across functions to be reconciled?

What level of consistency in risk criteria is necessary?

Variation in risk criteria is often justified by hazard characteristics, decision context and statutory purpose. What minimum shared concepts, assumptions or reference points are required to ensure this variation remains understandable and manageable across the wider system?

How should cascading and system-level risks be evaluated?

Current criteria are largely designed for individual hazards and bounded decision contexts. What constitutes acceptable, tolerable or intolerable levels of cascading and system-level risk, and how should these be reflected in future frameworks and guidance?

What is the appropriate relationship between nationally consistent thresholds and local decision-making?

Nationally consistent approaches may improve coherence and comparability, but local variation may be necessary to reflect differing hazard profiles, exposure, values and community priorities. How should future instruments balance national consistency with local flexibility?

6.4 Risk assessment: *Risk identification*

Risk identification involves mapping and describing risks that may prevent an organisation (or the system) from achieving its defined objectives. Across New Zealand, there are diverse sources (tangible and intangible) of risk, underpinned by varying causes, threats and opportunities, and vulnerabilities and capabilities. The magnitude of consequences will depend on the nature and value of assets and resources exposed.

6.4.1 Alignment within current practice

Risk identification is widely practised across hazards and functions.

Current practice addresses the core components of risk identification in a comprehensive but fragmented way, including:

- sources of risk: physical hazards, exposed people and assets
- causes and events: triggering conditions, failure mechanisms and scenarios
- consequences: impacts on life safety, property, infrastructure and community

These elements are identified across different instruments, but are not always integrated into a single, consistent definition of risk.

System-level frameworks establish high-level risk identification, but often at a descriptive or hazard-based level.

Instruments such as the National Risk and Resilience Framework and NCCRA (2026) identify nationally significant risks and their impacts across systems, including cross-sector consequences and interdependencies. However, these frameworks operate primarily at a strategic and system level, and the National Risk and Resilience Framework identifies risks as hazards themselves (e.g. “earthquake”, “flood”), rather than fully articulated pathways from hazard through to impact.

Function-level instruments identify risk in relation to decision objectives.

Emergency management (CDEM Act) identifies hazards, exposure, vulnerabilities and consequences, with a focus on impacts to communities and response capability. CDEM Risk Guidance also provides direction on including credible, maximum credible, and outlier events. Planning frameworks (Planning Bill, Natural Environment Bill, NZCPS) identify risks in terms of impacts on land use, property and people, linking hazard information to land-use decisions. These approaches more explicitly integrate hazard and consequence, but remain bounded by function-specific objectives, meaning risks are defined in terms of what matters for that decision context.

Hazard-specific guidance provides detailed identification of hazard processes and exposure, but is often hazard-led.

Technical standards and guidance (e.g. AGS Guidelines, NZGS Slope Stability Guidance, GNS Landslide Planning Guidance, NZ Coastal Guidance, tsunami guidance, stormwater modelling guidance) provide systematic and technically robust approaches to identifying:

- hazard sources, processes and spatial extent (e.g. hazard mapping, zoning)
- triggering conditions and failure mechanisms
- exposed people, assets and infrastructure.

These approaches provide strong coverage of causes, threats and direct hazard pathways, including both credible and extreme event scenarios. However, consequence and vulnerability are often addressed separately or implicitly, rather than fully integrated at the point of identification.

6.4.2 Where variation creates challenges

The following variations only create challenges for system coherence where there are not effectively documented and managed prior to the risk analysis and risk evaluation steps.

Different instruments identify fundamentally different types of “risk,” but this is not always made explicit, constraining comparability across the system.

Risk is identified at multiple levels across the system, including hazard presence, physical impacts, land-use effects, operational performance and system-level consequences. These reflect different decision purposes, but the distinction between them is not explicitly defined within or between instruments.

At the same time, hazard identification is frequently used as a proxy for risk. Many hazard-specific processes produce outputs such as hazard maps, zones or susceptibility classifications. These are essential for understanding exposure, but do not, on their own, constitute a full risk definition. In practice, these outputs are often used directly within planning and decision-making processes, meaning that hazard presence is implicitly treated as risk. This differs from frameworks that explicitly define risk in terms of impacts or system-level consequences.

As a result, outputs from different processes – such as hazard maps, engineering assessments, planning risk categories and national risk descriptions – are often treated as if they describe the same concept. In practice, they do not. This becomes most consequential where risks need to be aggregated, compared or prioritised across hazards, locations or functions.

Complex (cascading and compounding) risks are not consistently identified below the national level.

The NCCRA (2026) is the only reviewed instrument that comprehensively identifies cascading and cross-sector risks, including how impacts propagate across infrastructure, communities and economic systems. Notably, this is limited to ‘outward’ cascades and not risks generated outside of New Zealand which may result in domestic impacts (for example, population growth due to climate migration). Below this level, interactions are only addressed in limited, case-specific ways. For example, joint probability of sea-level rise and rainfall in flood hazard determination (National Stormwater Modelling Guide) and geotechnical guidance includes rainfall-triggered landslides. These remain confined to single-hazard extensions, rather than broader multi-hazard or system interactions.

Most planning, engineering and emergency management instruments identify risks within bounded domains or individual hazards, with interactions only considered in limited, case-specific contexts. This creates a disconnect between:

- how risks are understood at a system level, and
- how they are identified and managed in practice.

As a result, risks arising from interdependencies and compounding events are not consistently visible at the point of decision-making.

Variability in time-related factors reflects genuine differences in hazard behaviour but is not consistently documented or structured for comparison.

Return periods and planning horizons vary appropriately across hazards. Seismic hazards are assessed over long return periods (e.g. 250-2,500+ years) reflecting low-frequency, high-consequence events and long asset lifetimes; flood hazards are assessed over a variety of shorter return periods (e.g. 1-100 years with additional consideration of climate change) reflecting higher-frequency events and infrastructure service

expectations; coastal inundation that may occur rarely (100 years) presently is likely to occur daily within some planning horizons due to sea level rise; and wildfire and avalanche are assessed on a condition-based or seasonal basis, reflecting non-probabilistic behaviour.

This variation becomes problematic when risk estimates derived from incompatible time bases are compared or aggregated without adjustment. For example, directly comparing a 500-year seismic event with an annual flood event can misrepresent relative risk and distort prioritisation decisions.

The identification stage is the point at which timeframes and underlying assumptions should be explicitly documented, so they can be carried through to analysis and evaluation to enable system coherence. Where cross-hazard comparison is required, annualised probability provides the most consistent common basis, but its limitations – particularly for long return-period and condition-dependent hazards – should be recognised.

6.4.3 What this means: implications and discussion questions

The absence of a shared taxonomy for the level and type of risk being identified means that outputs from different instruments are treated as comparable when they are not.

This constrains system-level aggregation and prioritisation: investment decisions, multi-hazard assessments and cross-function coordination all depend on being able to compare like with like, and there is currently no framework to establish when that is or is not possible. The gap in cascading and multi-hazard identification at the operational scale compounds this, particularly as climate change increases the co-occurrence of events.

Table 5: Implications for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Differences in how risks are identified and described make it difficult to align risk management decisions across land use planning, infrastructure design and emergency management when they are addressing the same underlying risk.
Consistency within functions	Variation in what is recognised, documented and prioritised as a risk can result in similar risks being identified differently across organisations, regions and decision contexts.
Comparability across hazards	The absence of a shared taxonomy for identifying and describing risk, combined with differing temporal assumptions and scales of analysis, limits the ability to compare, aggregate and prioritise risks across hazards.

Key questions to address these implications include:

Should a shared taxonomy for risk identification be established?

Should future framing define minimum expectations for how risk is scoped and bounded – including clarity on level (e.g. site, local, regional, national) and type (e.g. hazard, impact, system-level risk) – to support comparability, without requiring uniform methods?

How should cascading and system-level risks be translated into operational practice?

What mechanisms are needed to ensure that risks identified at a system level are consistently reflected in planning, infrastructure and emergency management decisions, rather than remaining at a strategic level? Should future guidance establish clearer expectations or methods for identifying interdependent and cascading risks, beyond current single-hazard and single-function approaches?

How should less tangible sources of risk be incorporated?

What role should factors such as adaptive capacity, preparedness and social vulnerability play in risk identification, and how could these be better captured consistently across the system? There is an opportunity to learn from existing guidance (e.g. CDEM Risk Guidance).

6.5 Risk assessment: *Risk analysis*

Risk analysis under ISO 31000 requires understanding the nature and level of risk through consideration of uncertainties, risk sources, consequences, likelihood, scenarios, controls and their effectiveness. It should reflect time-related factors and the volatility of risks, as well as sensitivity and confidence levels. Natural hazard risk analysis is the primary focus of NZS 9420 which is presently under development.

6.5.1 Alignment within current practice

A common likelihood × consequence framing provides a shared structure across most instruments.

Across legislation, policy and guidance, risk is consistently framed as a function of likelihood and consequence, including in the CDEM Act, Emergency Management Bill, NPS-NH, CDEM Risk Guidance and selected hazard-specific guidance for flood (MfE, 2010) and tsunami (MCDEM, 2018). Slight variations exist including within the NCCRA (2026) which analyses risk level based on consequence, magnitude, and uncertainty, acknowledging the limitations of using likelihood under climate change (which means past likelihood will not be the same as future likelihood). This provides a common vocabulary that allows risk to be discussed across functions, even where underlying methods differ.

6.5.2 Where variation creates challenges

Fundamental and, in some cases, irreconcilable differences in how risk is analysed represent the most significant constraint on system coherence. Full standardisation is neither feasible nor desirable – but current variation is largely invisible, undocumented, and unmanaged.

Across the system, a wide range of analytical approaches are in use:

- **Fully quantitative, probability-based methods** are applied in several domains. For example, AGS Guidelines use annual probability of loss derived from event trees, fault trees, and probabilistic modelling. Similarly, NZS 1170.5:2025 and the Building Act rely on probabilistic seismic hazard analysis, while the NZGS Slope Stability Guidance applies geotechnical modelling with probability of failure and consequence estimation. The Seismic Risk Guidance for Buildings also combines probabilistic hazard analysis with structural performance modelling expressed as %NBS (how well an existing building performs against new building standards).
- **Semi-quantitative likelihood-consequence matrices** are widely used in planning and emergency management contexts. Examples include CDEM Risk Guidance, GNS Landslide Planning Guidance (which combines susceptibility mapping, frequency estimates, and consequence categories), Liquefaction Guidance under section 175 of the Building Act (which uses both a two- and four-point rating scale based on the level of precision and uncertainty), and the NPS-NH risk matrix.
- **Scenario-based and narrative approaches under conditions of deep uncertainty** are used where likelihood cannot be robustly estimated. The NCCRA (2026) employs qualitative assessments of consequence, magnitude, and uncertainty, explicitly recognising these limits, while the National Risk and Resilience Framework relies on scenario narratives without a transparent approach for determining risk level.
- **Consequence-focused operational assessments without formal likelihood estimation** are reflected in the Emergency Management Bill, which considers hazard characteristics, exposure, and potential impacts on people, infrastructure, and services to inform prioritisation rather than applying a formal risk model.

- **Financial loss modelling approaches** are used under the *Natural Hazards Insurance Act 2023*, which combines probabilistic hazard modelling with actuarial techniques to estimate expected financial loss, integrating hazard likelihood, exposure, and damage/loss functions.
- **Consequence-only or condition-based assessments** are used in specific domains. Fire Risk Assessment (NIWA, 2017) relies on weather-based fire danger ratings without a probabilistic likelihood component. The New Zealand Avalanche Danger Scale (NZ Avalanche Advisory, 2023) combines likelihood and avalanche size into categorical ratings. The National Space Weather Response Plan uses extreme-event scenarios focused on system impacts without likelihood estimation, while DOC's Volcanic Risk Management framework uses monitoring data and expert judgement in a dynamic, event-based approach.

These approaches differ in their definitions of likelihood, treatment of uncertainty, and output metrics. Non-climate hazards are often assessed using static, present-day likelihoods, whereas climate-related hazards are dynamic and evolving. A single 'snapshot' risk rating does not capture how risk changes over time, creating inconsistency and limiting comparability across the system. As a result, they cannot be translated or meaningfully compared without significant assumptions or an established moderation framework, creating a hard limit on multi-hazard risk aggregation and cross-sector comparison. Existing guidance within land-use planning (for example, NPS-NH implementation guide) and emergency management (including CDEM Risk Guidance) may be used to help moderate these differences, but their adoption is not consistent across the system.

Static likelihood-based expressions of risk may be misleading when probabilities are non-stationary.

Where underlying hazard behaviour is changing over time, expressing risk through fixed probability metrics (e.g. annual exceedance probabilities or average recurrence intervals) becomes increasingly unreliable and can mislead decision-making.

This is most evident for long-term, climate-driven hazards. The NZ Coastal Guidance highlights that as sea levels rise, events that were once rare become progressively more frequent, so traditional likelihood measures lose their meaning. As a result, coastal planning is shifting toward scenario-based and adaptive approaches.

At the other end of the spectrum, fire risk is assessed using condition-based danger ratings derived from current weather (e.g. wind, temperature, humidity, recent rainfall). This avoids the need to define stable probabilities in a changing system, but provides no clear way to represent how underlying risk is shifting over time.

Between these, flooding illustrates the transition problem (where practice still relies on historical probability estimates, but the assumptions behind them are progressively weakening). The NCCRA (2026) highlights that estimating likelihood is increasingly difficult, especially where hazards combine (such as heavy rainfall occurring alongside high sea levels).

Taken together, these examples point to a structural limitation of likelihood-based risk analysis, which depends on assumptions of stationarity that no longer hold in many contexts.

Effectiveness of existing controls: inconsistency undermines comparable risk outcomes.

Variation in whether and how existing controls are considered means that "risk" is not being assessed on a consistent basis across the system. In some contexts, controls are treated as integral to the assessment of risk (e.g. tsunami evacuation capability, DOC volcanic monitoring), while in others they are not systematically included.

There are valid reasons for this variation. For example, the Building Act and NZS 1170.5:2025 exclude non-structural controls – such as warning systems, land-use restrictions, and evacuation – from structural risk analysis to avoid overlap with planning and emergency management functions, and to maintain conservative,

design-based benchmarks. Conversely, the Natural Hazards Insurance Act incorporates controls implicitly through actuarial loss modelling, but without making these assumptions visible.

However, this leads to inconsistency in how risk is defined and compared. Coherence issues arise where decisions depend on a shared understanding of residual risk – such as across land-use planning, building design, emergency management, and insurance. In these cases, the same physical hazard can lead to different outcomes on level of risk depending on whether and how existing protections are accounted for, rather than on a consistent view of the risk that remains after controls.

Sensitivity and confidence levels: systematically absent from regulatory decisions.

Sensitivity and confidence levels are rarely reported or required in regulatory decision-making, meaning risk is not understood on a consistent or transparent basis across the system. While some instruments explicitly address uncertainty – such as the Liquefaction Guidance (s175 Building Act), which rates precision and confidence, and climate-related disclosure requirements which are clear on the need to state assumptions and certainty levels – most treat it only qualitatively (e.g. NCCRA, NZ Coastal Guidance) and do not carry this information through into decisions.

This creates a coherence problem where similar decisions are made using analyses with very different levels of confidence, without this being visible or weighed. As a result, decision-makers cannot consistently compare risks, prioritise interventions, or reconcile trade-offs across hazards, sectors, and locations, weakening both decision quality and system alignment.

Across planning, building consent, and emergency management, decision-makers routinely act on risk assessments whose assumptions and confidence levels are not reported. As a result, risks cannot be consistently compared, and trade-offs across hazards, sectors, and locations are harder to reconcile. This represents a systemic governance gap, particularly where risk analysis is used to determine whether development should be permitted, whether a building is earthquake-prone, or what risk reduction measures are required.

6.5.3 What this means: implications and key questions

The primary challenge for system coherence arising from risk analysis is not the existence of different approaches, but the absence of agreed mechanisms for documenting, interpreting, comparing and governing those differences across functions and hazards.

Variation in analytical methods is often necessary and appropriate, but without consistent documentation of assumptions, uncertainty, controls and limitations, it becomes difficult to determine whether differences in risk outcomes reflect genuine differences in risk or differences in how risk has been analysed.

The key system-level implications arising from the challenges identified in relation to risk analysis are summarised in Table 6.

Table 6: Implications for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Different analytical approaches can produce different interpretations of the same underlying risk, making it difficult to align decisions across land-use planning, infrastructure design and emergency management.
Consistency within functions	Variation in methods, assumptions, treatment of existing controls and treatment of uncertainty can result in similar risks being characterised differently across organisations, regions and decision contexts.

Dimension	Key implication
Comparability across hazards	Risks are expressed using different metrics, analytical approaches, timeframes and levels of uncertainty, limiting the ability to compare, prioritise or aggregate risks across hazards at a system level.

These implications raise several areas for consideration in the future framing of the natural hazard risk management system.

What is the minimum set of information that all risk analyses should provide?

Should future instruments establish minimum expectations for documenting methods, assumptions, limitations, treatment of controls, uncertainty and confidence levels to support transparency and interpretation across decision contexts? How should differences in confidence, assumptions, and treatment of controls be governed when aligning decisions across sectors?

Where is comparability most critical for decision-making, and where is variation acceptable or even necessary?

Different analytical approaches may be justified by hazard characteristics and decision context. In which situations is comparability essential for decision-making, and where is context-specific variation both acceptable and desirable?

How should dynamic and non-stationary risks be analysed?

How should future instruments support the transition from historical, probability-based methods to approaches that better reflect changing and non-stationary risks? What level and format of uncertainty disclosure (e.g. qualitative ratings, confidence scales) is proportionate and useful for decision-makers?

How should existing controls be represented within risk analysis?

Existing controls are considered inconsistently across hazards and functions, meaning similar risks may be assessed on different bases. Should future instruments establish clearer expectations regarding when and how existing controls are incorporated into risk analysis and reported transparently?

6.6 Risk assessment: *Risk evaluation*

Risk evaluation supports decisions through comparing results of the risk analysis with the established risk criteria and objectives (i.e. risk tolerance and level of service objectives), to determine where additional action is required. Additional action may include consideration of risk treatment, further analysis to understand the risk, maintain existing controls or revising objectives or risk criteria.

6.6.1 Alignment with current practice

Several instruments provide clear mechanisms linking assessed risk to decision-making.

Threshold-based approaches provide the most direct and explicit link between risk and decision outcomes. The NHC Risk Tolerance Methodology, while not mandatory, is the most comprehensive example, distinguishing between acceptable, tolerable, and intolerable risk. The NPS-NH similarly uses a four-point risk scale (low to very high), with defined planning responses at each level, including avoidance of very high risk and mitigation of high and medium risk. In the building system, the Building Act and Seismic Risk Guidance for Buildings establish clear regulatory cut-off points for earthquake-prone buildings.

Precautionary and adaptive approaches link risk to decisions without fixed thresholds. The NZCPS applies an “avoid increasing risk” principle, prioritising precaution over defined tolerances. The NZ Coastal Guidance uses adaptation thresholds and trigger points to guide staged responses over time, reflecting the need to

manage changing and uncertain risks before unacceptable outcomes are reached rather than relying on static cut-off points.

Judgement-based approaches use structured professional judgement to determine tolerability, often without fixed thresholds. The ALARP (As Low As Reasonably Practicable) framework – reflected in the AGS Guidelines and tsunami land-use planning guidance (Beban et al., 2019) – requires risks to be reduced unless further mitigation is disproportionate. Similarly, DOC volcanic risk management and avalanche advisory systems apply operational tolerances for visitor safety based on expert judgement, without formally defined, system-wide thresholds.

6.6.2 Where variation creates challenges

There is no consistent relationship between assessed risk levels and decision-making for risk treatment across New Zealand's natural hazard risk management system. This creates material inconsistency in how similar risks are managed, but not necessarily coherence issues.

Coherence issues are more likely to arise upstream, during the establishment of risk criteria and tolerance thresholds (see section 6.3), where differences in how risk is defined and evaluated affect the ability to align decisions across hazards, sectors, and functions.

Differences in the use of prioritisation tools, such as cost-benefit analysis (CBA), introduce further complexity in how risks are translated into treatment decisions. While CBA can provide a structured and transparent basis for prioritising interventions – particularly for non-climate hazards with more stable and well-characterised risk profiles – its application in long-term climate adaptation contexts is more challenging. Deep uncertainty, long time horizons, and evolving risk profiles make it difficult to robustly estimate costs and benefits, particularly when considering the cost of inaction or deferred decisions.

This creates a tension between approaches: clearer, more bounded assessments may support relatively straightforward treatment decisions for non-climatic hazards, whereas climate-related risks often require more iterative, adaptive decision-making under uncertainty. Variation in how these approaches are applied can lead to differing conclusions about appropriate levels and timing of intervention, reinforcing inconsistency in risk treatment even where underlying risks may be comparable.

6.6.3 What this means: implications and discussion questions

Risk evaluation is the point at which risk information is translated into decisions about whether action is required, what form it should take, and when it should occur. Differences in evaluation approaches can therefore lead to different decisions about similar risks, particularly where future risk, uncertainty and changing conditions are weighed differently.

Variation in evaluation frameworks is often appropriate given differing decision contexts. However, without clearer alignment in underlying risk criteria (Section 6.3), similar levels of assessed risk can lead to different conclusions about tolerability and the need for action. This challenge is amplified in the context of climate change, where risk is dynamic, uncertain, and evolving over time, and where static or present-day evaluation approaches may not adequately capture future conditions or the consequences of delayed action.

These observations raise several areas for consideration in the future framing of the natural hazard risk management system.

- How should risk evaluation frameworks account for changing and uncertain risk over time? Is greater emphasis needed on time-dependent tolerability, adaptation thresholds, or evolving risk benchmarks?
- What role should economic appraisal tools such as CBA play in risk evaluation under deep uncertainty? Are additional or complementary approaches needed to better account for the cost of inaction and long-term system impacts?

6.7 Risk treatment

Risk treatment covers the selection and implementation of options to modify risk: reducing likelihood or consequence, avoiding risk, transferring it, or retaining it. ISO 31000 also requires that treatment planning address responsibilities, resources, performance measures and monitoring requirements – and that residual risk be assessed and confirmed as acceptable before the process step is considered complete.

6.7.1 Alignment within current practice

The risk treatment step is where the system shows the most convergence.

Across natural hazard risk management instruments in New Zealand, a consistent and coherent suite of treatment options is applied. These include:

- Reducing hazard or vulnerability through physical measures (e.g. Building Act; AGS Guidelines; NZGS Slope Stability Guidance; GNS Landslide Planning Guidance);
- Managing exposure through land-use planning and avoidance (e.g. Planning Bill and Natural Environment Bill; NPS-NH; NZCPS);
- Building preparedness and response capability (e.g. CDEM Act; Emergency Management Bill; CDEM Risk Guidance);
- Supporting long-term adaptation (e.g. NCCRA (2026); NZ Coastal Guidance; NHC Risk Tolerance Methodology);
- Transferring financial risk through insurance (e.g. Natural Hazards Insurance Act); and
- Applying hazard-specific operational controls and emergency responses (e.g. Tsunami Assessment and Planning; DOC Volcanic Risk Management)

No fundamental clashes in how treatment options are understood across the system have been identified.

6.7.2 Where variation creates challenges

While the treatment options themselves are broadly aligned, there is no consistent approach to sequencing or prioritising treatments across the system.

While some instruments include optioneering or cost-effectiveness considerations (AGS Guidance and NPS-NH Implementation Guide), there is no shared expectation for how different treatment types (avoidance, mitigation, adaptation, response, transfer) should be prioritised relative to one another.

Partial hierarchies do exist within individual functions, but they are based on different organising logics and are not aligned across the system. Land-use planning provides the clearest hierarchy, generally prioritising avoidance of development in high-risk areas (e.g. NPS-NH, NZCPS), while infrastructure design focuses on meeting defined performance thresholds through mitigation, and emergency management applies the 4Rs as a non-hierarchical cycle. Hazard-specific guidance may introduce additional approaches (e.g. ALARP in landslide risk management), but these are not consistently applied or integrated across functions.

This becomes a system coherence issue where multiple functions are managing the same underlying risk through different treatment pathways without a common logic for how those pathways relate. For example, land-use planning may prioritise avoidance of high-risk areas, while infrastructure design continues to rely on mitigation through engineering standards, and emergency management plans to manage consequences through response capability. Each approach is internally coherent, but the absence of a shared prioritisation framework means they are not necessarily coherent in combination.

This constrains the system's ability to manage trade-offs across functions and to ensure that risk reduction efforts aggregate into coherent system-level outcomes, even where individual decisions are well-founded within their own contexts.

System-wide effects of treatments are not consistently considered.

Treatment decisions are typically evaluated within the boundary of the originating decision context. There is limited guidance on selecting treatments that may deliver co-benefits beyond the immediate risk context, or on assessing potential negative externalities. This can result in overlap, inefficiency, maladaptation, or the transfer – and in some cases escalation – of risk elsewhere in the system.

For example, decisions to accept risk or reduce investment in infrastructure may manage exposure within a specific asset or function, but can create unintended downstream consequences, such as increased vulnerability, reduced accessibility, or greater reliance on emergency response. These cascading effects may not be explicitly captured in the original risk assessment.

Clause 3.3(2)(c) of the NPS-NH requires that subdivision, use or development (including any associated mitigation measures) needs to avoid or mitigate the creation of, or increase in, significant risk on other sites. The extent to which this is considered in practice is unclear.

6.7.3 What this means: implications and discussion questions

Risk treatment does not constrain system coherence through diversity of approaches, but through lack of coordination.

The system is capable of applying a comprehensive set of treatments, but lacks the mechanisms to ensure that those treatments align, complement one another, and collectively manage risk across functions and hazards. The key implications of variation in the treatment process step are summarised below.

Table 7: Implications for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Treatment decisions are typically developed within individual functions, making it difficult to understand whether they collectively reduce risk, duplicate effort, transfer risk elsewhere, or create unintended consequences.
Consistency within functions	Similar risks may be managed through different treatment pathways depending on organisational preferences, resources, capability and guidance.
Comparability across hazards	Differences in treatment objectives, prioritisation approaches and decision frameworks make it difficult to compare the effectiveness and trade-offs of risk reduction efforts across hazards.

Key questions for consideration include:

How should treatment decisions account for wider system effects?

Treatment decisions can generate co-benefits, transfer risk, create unintended consequences or contribute to maladaptation. How should system-level effects of treatments (both positive and adverse) be considered and communicated? Should there be stronger expectations to assess and consult on cross-boundary impacts, co-benefits, and potential maladaptation?

Is a clearer hierarchy or prioritisation of treatment types required at the system level?

Current frameworks often emphasise different treatment pathways, such as avoidance, mitigation, adaptation, preparedness, response or risk transfer. What principles should guide the selection and sequencing of treatments where multiple approaches are available?

How should treatment effectiveness be evaluated?

What evidence should be used to determine whether treatments are achieving their intended outcomes, and how consistently should effectiveness be assessed across hazards and functions?

6.8 Recording and reporting

The risk management process and its outcomes must be documented and reported through appropriate channels.

6.8.1 Alignment with current practice

Recording and reporting of risk information is embedded across the system, but primarily as a by-product of other processes rather than as a coherent, system-wide function.

Several instruments require documentation or disclosure of risk within specific decision contexts. The most explicit alignment with ISO 31000 is climate-related disclosure requirements, as well as within emergency management. CDEM Risk Guidance requires structured documentation of risk assessments, including hazards, assumptions, consequences and prioritisation, which then inform CDEM Group Plans. These plans are publicly available and provide region-level articulation of risk, although typically in aggregated form.

At a national level, strategic instruments such as the NCCRAs (2020; 2026), NAP and the National Risk and Resilience Framework require periodic reporting of nationally significant risks. These provide visibility of risk at a system level, including cross-sector impacts and interdependencies, but operate at a high level and are not directly linked to operational or local risk assessments.

Within land-use planning, risk information must be presented to support plan-making and consenting processes under the RMA and forthcoming planning system reforms. However, reporting requirements are indirect: risk assessments are prepared to justify decisions rather than to meet consistent disclosure standards. There is no requirement for standardised reporting formats, comparable metrics, or systematic aggregation of risk information across regions.

In infrastructure design, the Building Act and associated standards (e.g. NZS 1170) require detailed documentation of hazard and risk considerations as part of engineering design and consenting. This supports regulatory accountability, but reporting is technical, case-specific, and generally confined to regulatory processes rather than publicly accessible or comparable datasets.

6.8.2 Where variation creates challenges

The absence of minimum disclosure requirements creates inconsistency in how risk is defined and interpreted.

Because instruments do not specify what must be recorded (e.g. assumptions, uncertainty, residual risk), similar risks may be reported differently across contexts. This limits the ability to interpret outputs consistently and undermines coherence across functions where decisions rely on shared understanding of risk.

Risk information is not structured for aggregation, limiting system-level coordination.

Recording and reporting are designed to support individual decisions rather than cross-system use. Without a common structure or metadata, risk information cannot be aggregated, constraining national prioritisation, coordination across functions, and assessment of cumulative or cascading risks.

Variation in the willingness to disclose risk transparently further limits system coherence.

In practice, reporting is not only shaped by formal requirements but also by how organisations choose to interpret and communicate risk. Where risk information is uncertain, contested, or has implications for development, liability or cost, there may be a tendency to simplify, defer, or limit disclosure. This results in

variability in how risk is represented across contexts, including differences in how uncertainty, limitations and residual risk are communicated.

From a system perspective, this introduces a further layer of inconsistency that cannot be reconciled through technical alignment alone. Even where similar analytical methods are used, differences in transparency affect how risk information is interpreted, compared and used in decision-making. This undermines coherence across functions by weakening the shared evidence base required to align decisions and manage trade-offs consistently.

6.8.3 What this means: implications and discussion questions

Variation in recording and reporting constrains system coherence by limiting the ability to compare, interpret and aggregate risk information across hazards and functions.

Improving recording and reporting is a foundational requirement for achieving a coherent, system-level approach to natural hazard risk management. Without a common basis for documenting and communicating risk information, differences in how risk is represented cannot be readily reconciled across hazards, functions or decision contexts. This limits the ability to align decisions, aggregate risk information, and learn from experience over time.

Key implications of the coherence challenges related to this step include:

Table 8: Implications for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Recording and reporting are not designed to support cross-functional decision-making, limiting the ability to reconcile risk information generated through land use planning, infrastructure design and emergency management processes.
Consistency within functions	The absence of minimum disclosure expectations means similar risks may be represented differently across organisations and regions, reducing transparency and accountability.
Comparability across hazards	Differences in how risk assessment outputs, assumptions, uncertainty and residual risk are documented limit the ability to compare or aggregate risk information across hazards.

This raises several key considerations for future system development:

What aspects of recording and reporting require standardisation to support system coherence?

Should a common reference framework, metadata standard, or translation mechanism be developed to enable aggregation of risk information across hazards, regions and sectors?

What level of comparability is necessary to support system-level decision-making?

Where is it essential for risk information to be comparable to support national prioritisation and investment decisions, and where is variation acceptable?

What minimum information should be consistently recorded and disclosed?

For example, should all risk assessments include a common set of elements such as assumptions, uncertainty, and residual risk to support consistent interpretation?

How should transparency be governed across the system?

Should clearer expectations be established to ensure that differences in disclosure do not undermine the ability to align decisions and manage trade-offs across functions?

6.9 Monitoring and review

Under ISO 31000, monitoring and review is a continuous activity, not a closing step. It verifies whether the risk management process is performing as intended, confirms that existing controls remain effective, detects changes in hazard profiles or context that may require reassessment, and provides the evidence base for improvement over time.

6.9.1 Alignment in current practice

Monitoring and review are widely recognised across the system, but are primarily embedded within specific strategies, hazards or functions rather than applied consistently at a system level.

At a national level, several instruments establish structured review cycles. The CCR Act enables iterative NCCRA and NAP updates, which include monitoring of climate-related risks and adaptation progress. The National Risk and Resilience Framework and National Disaster Resilience Strategy similarly include periodic review and performance indicators.

Hazard-specific domains demonstrate more integrated monitoring where risks are dynamic. NZ Coastal Guidance uses adaptation thresholds and trigger points to prompt reassessment, while volcanic, avalanche and space weather frameworks rely on continuous monitoring and expert judgement.

Scientific monitoring of hazards is also well established, including updates to seismic hazard models and climate projections.

6.9.2 Where variation creates challenges

Monitoring and review are not implemented as a system-wide function, limiting coherence across hazards and functions.

Monitoring approaches are defined within individual strategies, hazards or sectors, with no shared objectives, indicators or metrics across the system. This means there is no consistent way to assess whether risk management decisions across planning, infrastructure and emergency management are aligned or collectively effective.

Different functions monitor different aspects of risk (e.g. hazard behaviour, asset performance, response capability) using different measures and timeframes. Without a common basis for interpreting these outputs, changes in risk cannot be consistently understood or acted on across functions managing the same underlying risk.

System-level visibility of changing risk is fragmented, reinforcing a reactive approach to natural hazard risk management.

National-level monitoring (e.g. NCCRA, NAP) provides insight into some risks, particularly climate-related, but is not integrated with monitoring in other parts of the system. As a result, there is no coherent, shared view of how risk is evolving across hazards and sectors, constraining coordinated responses to emerging or escalating risks.

In the absence of this visibility, the system relies on event-driven signals rather than continuous understanding of change. This reactive position is not consistently supported across functions, which are differentially equipped to respond, leading to uneven and uncoordinated adjustments over time.

The absence of consistent expectations for monitoring also means that changes in hazard information, exposure or treatment performance are not systematically connected back to earlier process steps (e.g. risk

assessment or treatment decisions). This limits the system's ability to update decisions in a consistent way across functions, reinforcing divergence over time.

6.9.3 What this means: implications and discussion questions

The absence of a coordinated approach to monitoring and review limits the system's ability to develop a shared understanding of changing risk over time.

While monitoring occurs across many parts of the system, it is largely fragmented across hazards, sectors and functions, making it difficult to identify emerging risks, evaluate collective performance and adapt risk management decisions in a coordinated way. Implications are set out in Table 9.

Table 9: Implications for coherence across functions, consistency within functions, and comparability across hazards.

Dimension	Key implication
Coherence across functions	Monitoring is undertaken largely within individual functions, making it difficult to understand how changing risks, treatment performance and emerging issues should influence decisions across land use planning, infrastructure design and emergency management.
Consistency within functions	Different organisations monitor different aspects of risk using different indicators, objectives and timeframes, limiting the ability to consistently assess performance and improvement across regions and decision contexts.
Comparability across hazards	Fragmented monitoring approaches limit the ability to identify trends across hazards, understand emerging multi-hazard and cascading risks, and develop a coherent picture of changing risk at a system level.

Several key considerations for future system development include:

Should monitoring and review be established as a core, system-level function of natural hazard risk management, with defined expectations across all hazards and sectors, rather than remaining embedded within individual instruments?

What level of integration is required across existing monitoring approaches? And how could national, hazard-specific and function-specific monitoring systems be connected to provide a coherent view of risk over time?

What would constitute an appropriate set of system-level objectives, indicators, and metrics for monitoring natural hazard risk management performance in New Zealand?

What level of alignment with international reporting requirements is required and at what levels to enable New Zealand to meet its obligations (e.g. Global Goal on Adaptation established under the Paris Agreement)?

Should future instruments require explicit linkages between risk treatment and monitoring, including tracking of residual risk and effectiveness of interventions?

Should future instruments establish stronger expectations for connecting monitoring outputs to risk assessment, evaluation and treatment decisions, including defining triggers for reassessment, adaptation or intervention?

7 Summary of implications and considerations

Sections 4–6 demonstrate that natural hazard risk management in Aotearoa New Zealand is both extensive and, in many cases, well-developed within individual domains. However, variation in how ISO 31000 Principles, Framework and Process are reflected across instruments reveals persistent challenges for coherence across functions, consistency within functions, and comparability across hazards.

This section synthesises the findings of the report to set out key implications and considerations for improving coherence across the natural hazard risk management system in New Zealand, providing a basis for discussion, testing and future development.

A central insight from the analysis is that the system does not lack capability, but lacks the structures needed to convert distributed capability into coherent system-level outcomes. The implications below therefore focus not on the performance of individual instruments or domains, but on how the system behaves as a whole – and what this suggests about how future instruments need to be framed if greater coherence is to be achieved in areas where it is desirable.

The system is structurally fragmented rather than simply complex.

The current system is often described as complex, reflecting the number of actors, instruments and hazards involved. However, the analysis indicates that the primary issue is not complexity per se, but structural fragmentation.

Risk management frameworks, processes and decision logics have evolved separately across land-use planning, infrastructure design and emergency management, each embedded in different legislative mandates, governance arrangements and technical frameworks. This structural separation produces a consistent pattern:

- Internally coherent subsystems (whether these are functions, hazards or decision-contexts)
- Externally weak alignment between those subsystems
- No mechanism to ensure that decisions made in one part of the system are compatible or effective when compared with those made elsewhere.

The result is a system in which outcomes are path-dependent (shaped by which function initiates the decision) and often do not reliably combine into coherent system-level risk management.

Considerations for future development of the natural hazard risk management system in New Zealand

Coherence cannot be achieved by incrementally improving individual instruments in isolation. Instead, instruments need to be framed with explicit recognition that they are components of a larger system, including how they:

- interact with other decision processes;
- depend on outputs from other domains; and
- influence downstream risk management pathways.

Variation operates as an ‘ungoverned dimension’ of the system.

Differences in risk concepts, analytical approaches, criteria and evidence reflect the diversity of natural hazard and decision contexts. These differences are rarely made explicit in a consistent way, compared across domains, or subject to any overarching logic or translation. As a result, variation accumulates silently within the system, and only becomes visible at points where decisions must be aligned – at which point it manifests as inconsistency or potentially conflict.

Considerations for future development of the natural hazard risk management system in New Zealand

The implication for future framing is not that variation should be reduced, but that it must be made legible and governable at a system level. This requires:

- explicit articulation of assumptions and methodological choices;
- shared reference points for interpreting differences; and
- mechanisms to manage how different approaches relate to one another in practice.

Without this, the system will continue to rely on implicit judgement to reconcile differences, limiting transparency and consistency.

The system lacks a mechanism to reconcile different representations of risk.

A particularly significant consequence of unmanaged variation is that the system has no effective way to reconcile different representations of risk. Across instruments, risk is variously expressed as probabilistic metrics, qualitative categories, performance thresholds (e.g. building standards), and scenario-based narratives. Each of these is internally valid (and useful!), however there is no shared framework for translating between them, determining equivalence or relative significance, or aggregating them into a system-level view.

This means that the system cannot reliably answer the question “which risks matter most?” across hazards, sectors or locations.

This has practical consequences for investment prioritisation, sequencing of risk management interventions (programmes, treatments, governance design) and management of cascading and systemic risks.

Considerations for future development of the natural hazard risk management system in New Zealand

For future instruments, this points to the need for introducing translation or moderation functions within the system. These do not need to standardise methods, but must enable:

- comparison across different analytical approaches
- consistent interpretation of risk levels
- alignment of decisions where multiple frameworks intersect.

The system is not yet configured to manage risk as a dynamic, system-level condition.

The analysis highlights a shift in how natural hazard risk management is understood – from discrete, hazard-specific events to dynamic, system-level processes shaped by climate change, interdependencies, and cascading effects across infrastructure and communities.

This shift is increasingly reflected in current and proposed reforms, particularly in spatial planning and adaptation frameworks, which emphasise long-term planning, interconnected systems and the need to avoid increasing risk over time. However, it is not yet consistently translated into how risk is managed in practice across the system. Monitoring and review remain fragmented, risk assessments are typically bounded to single hazards or sectors, and decision frameworks are not systematically linked to changing risk over time.

As a result, the system is able to identify system-level risks at a strategic level (such as network-scale disruption or cascading failure caused by a natural hazard event), but continues to manage them through functionally bounded processes that do not fully reflect their interconnected and evolving nature. This creates a structural disconnect between the direction of reform and the way the system currently operates.

Considerations for future development of the natural hazard risk management system in New Zealand

Improving coherence will therefore require a more explicit integration of system-level and cascading risks into operational processes, stronger linkages between monitoring, assessment and decision-making, and greater use of approaches that can accommodate evolving and non-stationary risk over time. This is a critical role that emerging standards – including NZS 9420 and NZS 9421 – could play.

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Appendix A – Natural hazard risk management instruments

Table 10: Key natural hazard risk management instruments and their relationship to example system functions.

Instrument	Type	Land-use planning	Infrastructure design	Emergency management
Resource Management Act 1991	Legislation	✓		
<i>Building Act 2004</i>	Legislation		✓	
<i>Civil Defence Emergency Management Act 2002</i>	Legislation			✓
<i>Local Government Act 2002</i>	Legislation	✓	✓	✓
<i>Natural Hazards Insurance Act 2023</i>	Legislation	✓	✓	✓
<i>Climate Change Response Act 2002</i>	Legislation	✓	✓	✓
<i>Fire and Emergency New Zealand Act 2017</i>	Legislation			✓
<i>Emergency Management Bill</i>	Planned reform			✓
Planning Bill and Natural Environment Bill	Planned reform	✓		
National Policy Statement – Natural Hazards (2025)	Policy	✓	✓	
<i>New Zealand Coastal Policy Statement (2025)</i>	Policy	✓		
<i>National Risk and Resilience Framework</i>	Framework	✓	✓	✓
National Adaptation Framework	Framework	✓	✓	✓
<i>National Disaster Resilience Strategy 2019–2029</i>	Strategy	✓	✓	✓
<i>Strengthening Disaster Resilience and Emergency Management</i>	Strategy / Plan			✓
National Climate Change Risk Assessments	Strategy / Plan	✓	✓	✓
National Adaptation Plan	Strategy / Plan	✓	✓	✓
National Space Weather Response Plan	Strategy/ Plan			✓
<i>NZS 9420: Risk analysis</i>	Standard (in development)	✓	✓	✓
<i>NZS 9421: Flood hazard modelling and risk assessment</i>	Standard (in development)	To be determined		
AS/NZS 1170 and TS 1170.5: 2025	Standard		✓	
NPS-NH Implementation Guide (2026)	Guidance	✓	✓	
<i>Risk Assessment: Guidance for CDEM Group Planning</i>	Guidance			✓
NHC Risk Tolerance Methodology	Guidance	✓	✓	✓
Planning and engineering guidance for liquefaction-prone land	Guidance		✓	
GNS Landslide Planning Guidance	Guidance	✓	✓	
NZGS Slope Stability Guidance	Guidance	✓	✓	
AGS Guidelines for Landslide Risk Management	Guidance	✓	✓	
Preparing for Future Flooding	Guidance	✓		

Instrument	Type	Land-use planning	Infrastructure design	Emergency management
National Stormwater Modelling Guide	Guidance	✓	✓	
NZ Coastal Hazards and Climate Change Guidance	Guidance	✓		
Forest Fire Risk Management Guidelines	Guidance	✓		✓
Assessment and Planning for Tsunami Vertical Evacuation	Guidance	✓		✓
Integrating tsunami inundation modelling into risk-based land-use planning: An update of guidance	Guidance	✓		
Guidelines for DOC Volcanic Risk Management in Tongariro National Park	Guidance			✓