Becoming Floodwise: Awareness and action for Aotearoa

Prepared by Christina Hanna, Silvia Serrao-Neumann, Emily Lane and Simone Philips. 2025

Te whāriki o te wai
Mā te haumaru o ngā puna wai o Rākaihautū ka ora mō ake tonu

Earth Sciences New Zealand

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

A flood exposed landscape

Flooding is Aotearoa New Zealand's most frequent damaging natural hazard, and over 750,000 people live in areas that could be affected by flooding. Hundreds of thousands of buildings are identified as being located in flood hazard areas, valued at approximately $235 billion. The majority of these buildings are peoples' homes.

As a result of climate change, storms are getting more intense and harder to predict, and development is still happening in flood-prone areas. Together, these challenges make it harder to keep people and communities informed and safe from harm.

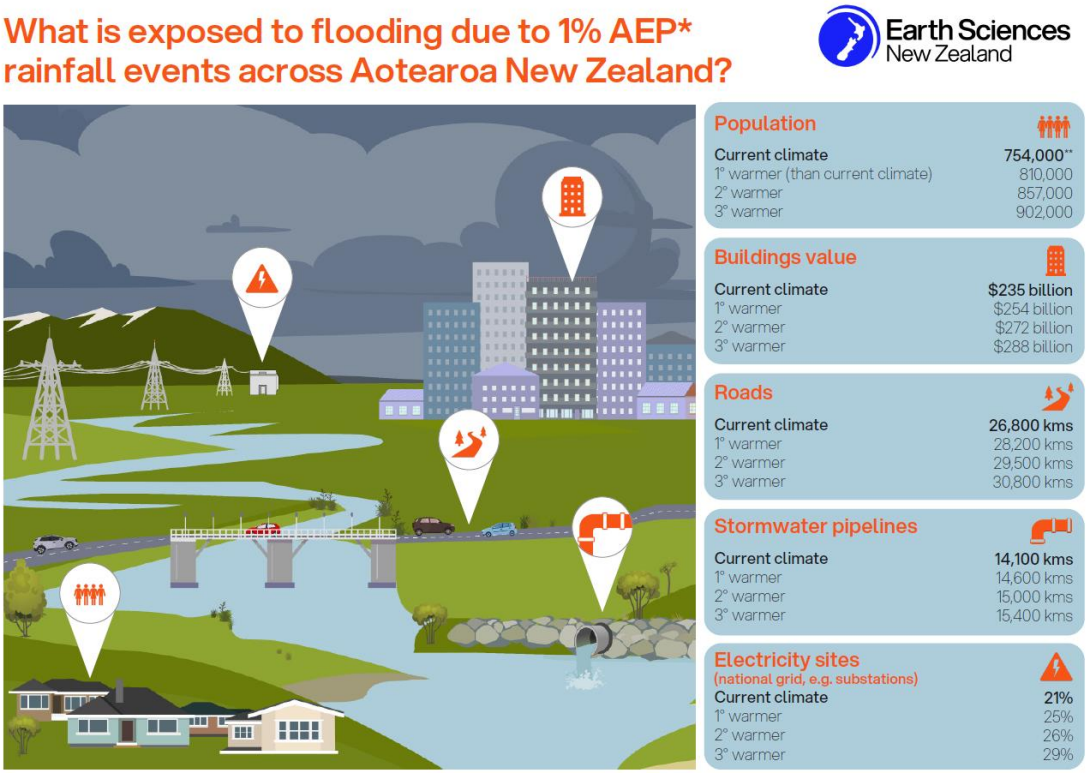

Figure 1. Aotearoa flood exposure (Full size here)

Building a better way forward

This booklet shares findings from *Mā te haumaru o ngā puna wai o Rākaihautū ka ora mō ake tonu*, a research programme seeking to support a consistent national approach to reduce flood risks.

The aim of the programme: To create a national system to map flood hazards and assess physical risks, factoring in climate change. This will help communities and decision-makers alike build stronger, safer futures for us all.

As a part of this programme, researchers have collected valuable insights from experts and planning practice across the country. They have done this through interactive workshops and discussions, or *Science-Practice Roadshows,* and policy analysis.

You can find out more about the research programme here: https://niwa.co.nz/hazards/ma-te-haumaru-o-nga-puna-wai-o-rakaihautu-ka-ora-mo-ake-tonu

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Making sense of our flood risk

Historically, planning for flooding has focused primarily on the development of structures, such as stopbanks, designed to contain water to a predefined level.

Yet this fixed approach leaves little flexibility for changing conditions. Terms like '1 in 100-year flood' can also give a misleading sense that risk is static and predictable.

A '1 in 100-year flood' refers to a flood event that has a 1% chance of occurring in any given year — not that it only happens once every 100 years. There is a 26% chance that this kind of flood will happen over a 30-year period.

Probability is not prediction — the chance might be low, but events can still happen multiple times in quick succession. For example, two '1-in-100-year' floods could occur in back-to-back years, or even in the same year.

Plus, with climate change, more intense, and more frequent floods can be expected going forward.

Making sense of our flood risk

Flood risk is not just about the **height** water could reach and how it **flows** (*hazard*). It is about **who** and **what taonga or values** are in its path (*exposure*), and how much **harm** could result (*vulnerability*).

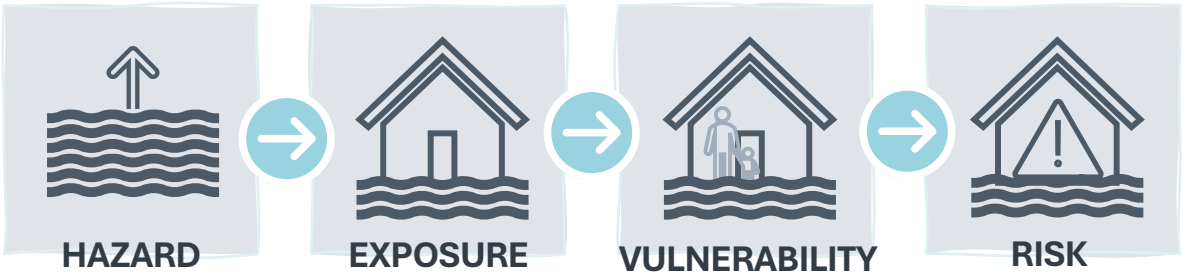
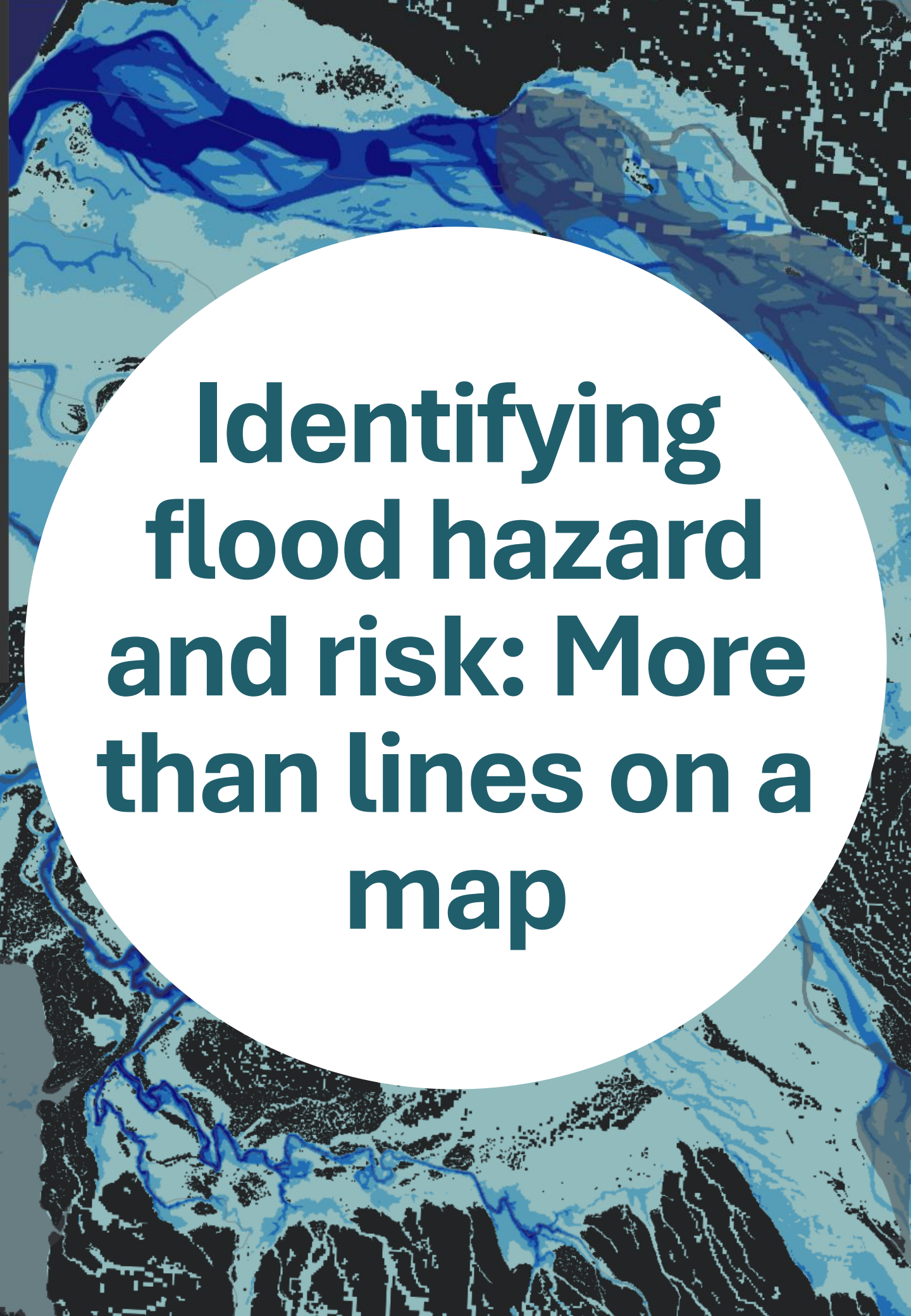


Figure 2. Explaining flood risk

Even large stopbanks do not remove the danger completely, and there is always a chance that they could fail or overflow. In 2023, Cyclone Gabrielle showed us the devastating effects of these systems becoming overwhelmed.

To keep people, infrastructure networks, places, and other things we value safe, we need to think beyond flood hazard alone, and start planning for risk in all its dimensions, including consideration of vulnerability.



Identifying flood hazard and risk: More than lines on a map

How do we identify flood hazards & risks?

Flood hazard maps and risk assessments are powerful tools for communicating information and supplementing regulatory decisions, but not all flood assessments are the same. Internationally and in Aotearoa, **two key types** are used:

1. FLOOD HAZARD MAPS:
Numerically simulated maps showing intensity parameters like maximum flood depth and flow velocity, for a certain flood severity (AEP/ARI).

2. FLOOD RISK ASSESSMENTS:
Combine flood hazard maps with socio-economic data (exposure and vulnerability) to produce assessments of risk.

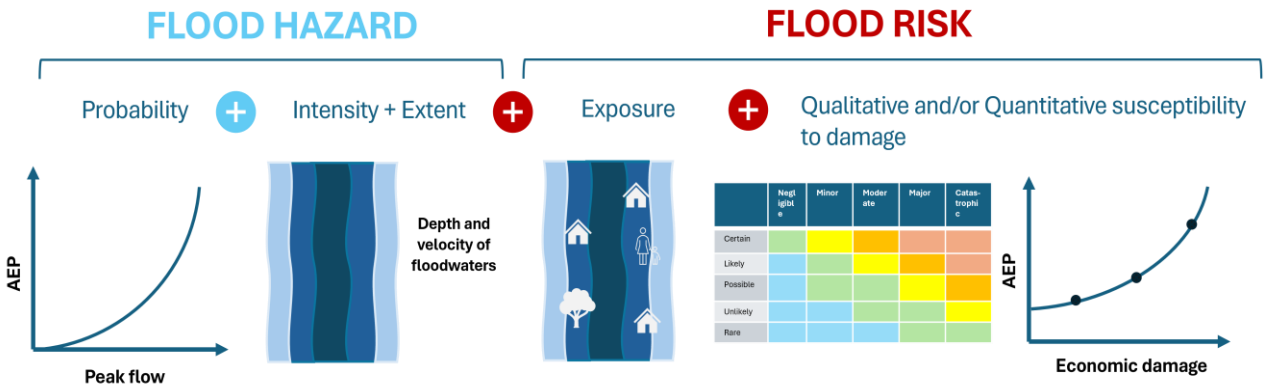


Figure 3. Explaining flood hazard and risk assessments

Flood hazard maps are commonly used in Aotearoa to indicate where flood prone areas are. Flood risk assessments are increasingly used to support regulatory decision-making.

Flood likelihood and severity

The severity of a flood is expressed in terms of its long-term likelihood of occurring. Two common measures are Annual Exceedance Probability (AEP) and Average Recurrence Interval (ARI). These are based on an area exceeding a certain **amount of rainfall** or a **river** reaching a specific **peak flow rate**.

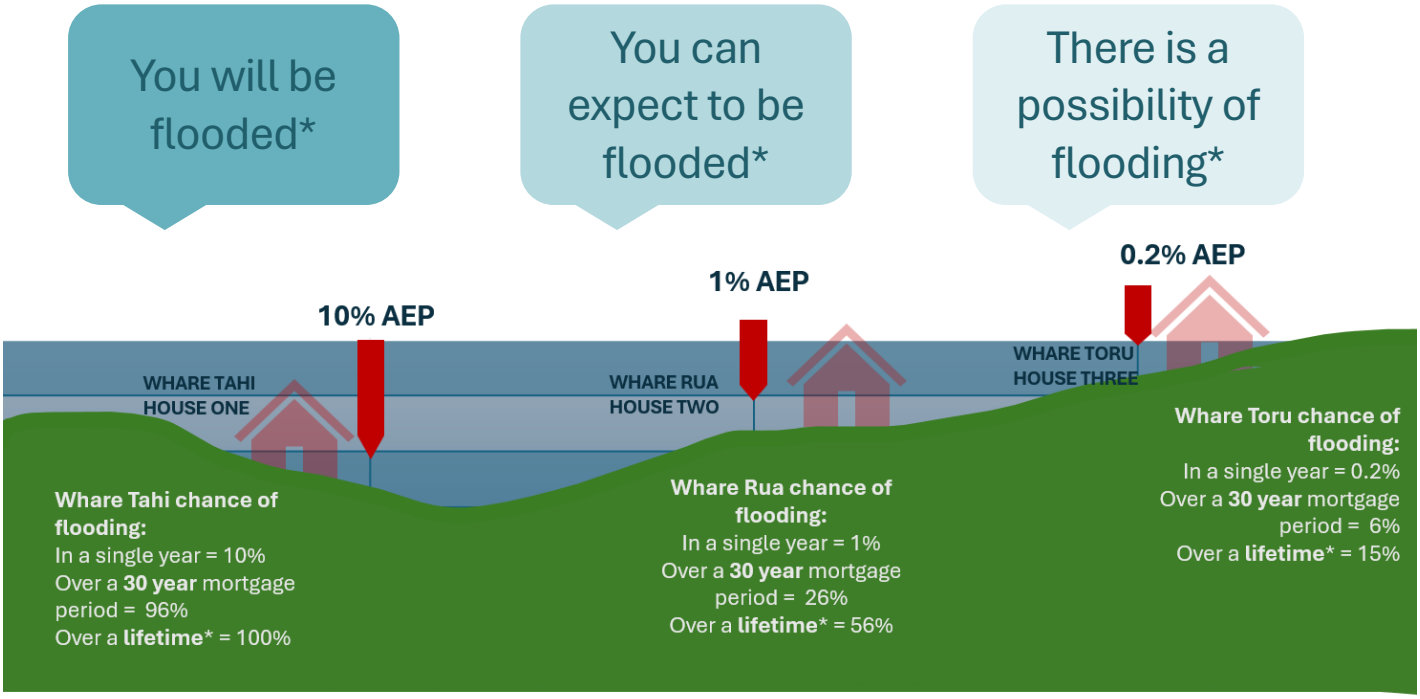
AEP represents the **probability** of a flood of a certain size occurring in any given year. **ARI** expresses the **average time interval** between floods of a given size. For instance, a flood with an AEP of 1% has an ARI of 100 years and is expected, **on average**, once every 100 years. However, this does not mean it cannot occur more than once in that period—it is a statistical average, not a guarantee.

Annual Exceedance Probability (AEP)	Annual Recurrence Interval (ARI)
20%	1 in 5 year event
10%	1 in 10 year event
2%	1 in 50 year event
1%	1 in 100 year event
0.5%	1 in 200 year event
0.2%	1 in 500 year event

Councils use different AEPs for setting flood zones and designing infrastructure and regulations. Some plan for more frequent events, such as a flood that has a 10% chance of occurring each year, and some plan for rarer, more severe events (0.2% AEP), while others plan for somewhere in the middle (e.g. the 1% AEP).

What does this all mean for me?

The following diagram communicates different flood event frequencies across a **single year**, a **30 year** mortgage period, and a lifetime (***82 year** average), to contextualise the chance of flooding for a range of AEPs.



*Lifetime = 82 years (average life expectancy for general population)

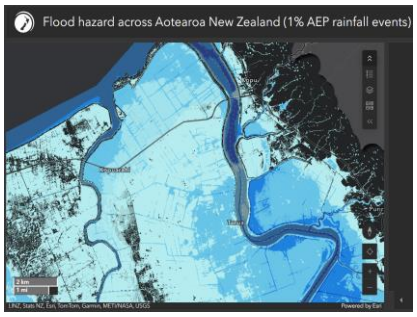
Figure 4. Explaining flood event frequencies

When examining flood hazard maps such as the Earth Sciences Nation-Wide Flood Viewer (1% AEP) or council flood maps (various AEPs), you can refer to this diagram to consider the chances of being flooded at a given place, over these timeframes.

Nation-Wide Flood Viewer

The Earth Sciences New Zealand Nation-Wide Flood Viewer allows the public to see whether their communities are within areas at risk from 1% AEP rainfall events.

Climate change is projected to increase the intensity of rainfall events which increases the risk of flooding. Therefore, the Nation-Wide Flood Viewer also shows how our flood exposure could change under future climate scenarios (1% AEP under the current climate, with 1°C, 2°C and 3°C of global warming).



Key Nation-Wide Flood Viewer inputs	
Historic flood information	✓
Rainfall data (HIRDS)	✓
Land topography (LiDAR)	✓
Landcover (Roughness data)	✓
Watercourse data:	
Stopbank data (NZIS Inventory of Stopbanks)	✓
Digital river network (REC2.5)	✓
Tidal data (Coast levels)	✓
Climate change (Temporal temperature increments)	✓
Stormwater:	
Open drainage system	✓
Overland flow paths	✓

Making sense of flood maps in Aotearoa

There are multiple maps providing flood hazard information in Aotearoa. The main purpose of the Nation-Wide Flood Viewer is to identify areas most at risk, supporting national policy, risk assessment and investment planning. It also fills gaps for locations that don't have this information. The Nation-Wide Flood Viewer was not designed for hazard and exposure analysis at higher resolutions (e.g., property level). If you try to zoom closer than street level, the flood layers will be disabled. Many councils have created high-resolution maps of flooding exposure for this purpose. You can find these maps by selecting the regional dropdown menu inside the Nation-Wide Flood Viewer. The following indicates expected uses for the Nation-Wide Flood Viewer and for detailed council flood maps:

Map type	Scale	Expected uses
Earth Sciences NZ Nation-Wide Flood Viewer	National-local scale	• National planning, emergency management and investment decisions <u>Where detailed local modelling is not available:</u> • *Local risk communication* • *Regional and local spatial plans/strategies* • *Community scale emergency management planning* • *Inform triage of more detailed modelling*
Detailed district and regional flood hazard maps	Regional/ local-property scale	• Local risk communication • District Plan zoning, regulation, resource and building consents • Local adaptation planning • Regional and local spatial plans/strategies • Emergency management and evacuation planning • Operational uses and infrastructure strategies • Investment and policy decisions

Towards a more resilient Aotearoa

Towards a more resilient Aotearoa

Resilience is not about holding back water forever, but it is about helping people, places, and systems adapt to a changing world. This means:

- Planning for uncertainty
- Reviewing strategies often and updating them as required
- Strengthening communities, not just defences
- Making information clear and accessible so people can make informed choices

Water is part of our past, present, and future, and flooding is a part of that. With the right maps, tools, and leadership, we can shape a safer, more resilient Aotearoa.

The following checklists highlight practical steps for two groups:

1. Communities and individuals (managing your own risk)
2. Policy & decision-makers (building system-wide resilience)

Flood awareness checklist: Communities and individuals

Know your risk

☐ Check your property's Land Information Memorandum (LIM) for flood hazard and risk details

☐ Look at your local council flood maps online as your first source of information for flood hazard exposure.

☐ View the Earth Sciences Nation-Wide Flood Viewer here

☐ Understand flood modelling terminology and map uses (see pages 8 -12 of this guide)

☐ Find out what to do before, during and after flooding: https://getready.govt.nz/emergency/floods

Protect your home/place of residence

☐ Avoid converting sheds/garages into living spaces in flood zones

☐ Review your insurance, retrofitting options, or relocation plans

Understand flood defences

☐ Find out the design flood level of your local flood defences

☐ Understand residual risk (e.g. big floods can overtop stopbanks)

Flood awareness checklist: Policy & decision-makers

Push for consistency

☐ Support a national framework with clear standards for flood hazard mapping, directive regulatory controls and risk assessment

☐ Coordinate across agencies to share data and methods

Use maps wisely

☐ Match the map's scale to the purpose: regional maps for strategy, detailed maps for site-level planning

☐ Flood maps that are connected to planning rules should be incorporated in regulatory plans, accessible, and open for public input.

Plan for uncertainty

☐ Embed climate change scenarios into modelling

☐ Map and regulate residual risks

☐ Communicate clearly with the public about map limitations and uncertainty

Strengthen resilience & equity

☐ Consider risks to ecosystems, taonga, culture, and community wellbeing alongside risks to human life, property and assets.

☐ Invest in emergency management capacity and alternative evacuation routes

☐ **See our Policy Briefs here for more detailed recommendations.**

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