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COMMERCE COMMISSION NEW ZEALAND
Te Komihana Tauhokohoko

Resilience Principles: Decision-making framework for critical infrastructure providers

Draft guidance document

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Foreword - Infrastructure resilience in New Zealand

Essential infrastructure, such as telecommunications, electricity, gas, airports, and drinking, waste and storm water, are critical enablers of New Zealanders' daily lives and economic activity. While these services are often taken for granted, their loss during extreme events can be severely disruptive. New Zealand is particularly exposed to natural hazards, including climatic, volcanic and seismic events, and is also facing growing threats such as cyber-attacks. Recent storms and flooding have highlighted these risks, and with increasing frequency and severity expected, it is essential that infrastructure providers take a structured approach to resilience planning and investment, and are well prepared to respond when events occur.

As part of our regulatory role across infrastructure sectors, the Commission intends to take a greater role in resilience. The purpose of this document is to set out, for consultation, cross-sector guidance to infrastructure providers on how we will seek assurance that resilience needs and investment decisions reflect good practice.

It sets out key resilience principles, supported by examples, and our high-level expectations of the types of approaches infrastructure providers should take when assessing resilience investments, alongside examples of what good looks like. It also signals the direction of travel toward more mature resilience practice over time. The guidance is intended to be practical and accessible for those responsible for overseeing resilience planning and investment decisions within infrastructure organisations.

Investing in assets and systems is a core operational activity for infrastructure providers, and we expect this to increasingly reflect good practice in resilience. We recognise that there are different levels of maturity in resilience systems, assessments and planning across infrastructure sectors in New Zealand. Providers at an earlier stage should not delay incorporating resilience considerations into current investment decisions, and should continue to build capability toward best practice over time.

In some sectors, such as water, where providers are transitioning to new entities and regulatory arrangements, current maturity may be lower. But given the wave of investment that is required in water services networks, now is the best time to ensure investments in new assets take account of resilience from the outset.

For more mature network providers with more gradual investment cycles, resilience investments are more likely to focus on critical hazard risk exposures, and on the progressive hardening of networks to avoid adverse impacts on consumers.

For price-quality regulated businesses seeking approval for resilience expenditure, clear demonstration of systematic and robust resilience planning and investment decision making will be important to support the revenue allowances sought, particularly where material expenditure is proposed.

We emphasise that at the heart of good resilience practice is the need to engage and communicate effectively with consumers and communities on current service resilience and preparedness (e.g., what communities can expect with current assets and states of readiness), and on well-considered options for improving resilience. This includes recognising that impacts are not experienced evenly, and that local context, including iwi and hapū perspectives and the role of communities in supporting resilience, can shape appropriate responses and investment priorities.

This should be supported by systematic assessment of risks and consideration of a range of mitigation options, including accepting risk, strengthening community preparedness, enhancing response capability, or undertaking infrastructure investment. Where multiple infrastructure networks are affected by hazards, we expect effective collaboration between infrastructure providers, relevant local authorities and Lifelines Groups. We expect to see resilience initiatives well integrated as a subset of asset management systems that work together coherently.

Our emphasis on community engagement and a systematic approach reflects a concern that appropriate levels of resilience will not be achieved through ad hoc measures that are not informed by a clear understanding of community needs, impacts and trade-offs. Many resilience investments address low-probability, but high-impact scenarios, of which there are many. It will not be efficient to mitigate every risk through infrastructure hardening. Decisions will often involve trade-offs between cost, resilience and service levels over time, with consumers ultimately bearing the costs and benefits of those choices. Effective option development and cost-benefit analysis are therefore critical in developing resilience investment priorities.

Resilience is critical to New Zealanders. The Commission welcomes engagement on these principles and how they should be applied as infrastructure providers and stakeholders develop their systems and plans.

Nathan Strong

Associate Commissioner

Chapter 1 Introduction

Purpose of document

1.1 This document provides guidance for infrastructure providers regulated by the Commerce Commission that are evaluating resilience investments. It outlines the key principles for infrastructure investment decisions that infrastructure providers should consider when developing resilience investment cases and proposals and sets expectations on the level of analysis we would generally expect to see under each principle. It also provides infrastructure providers with a range of decision-making frameworks to use and additional resources to suit different investment needs and maturity.

1.2 This document is a guidance document for infrastructure providers. It is not a requirement for each infrastructure provider to immediately and fully incorporate into their decision-making processes. It does, however, outline the level of consideration we will expect to see over time from infrastructure providers, as resilience planning and asset management maturity develops, especially when they are undertaking resilience-specific projects or applying for additional revenue for resilience purposes.

1.3 This chapter sets out the context for this guidance and how it should be applied. Chapter 2 sets out the principles that underpin robust resilience decision making. These principles all apply in every case, just to different extent - with the level of expected analysis proportionate to the scale, context and materiality of the investment being considered. Chapter 3 provides indicators of what 'good looks like' in applying these principles. Chapter 4 presents different decision-making frameworks and tools, and Chapter 5 provides links to further information on resilience and effective community engagement.

1.4 We are seeking feedback on this draft guidance document. Information on how to make a submission, including optional consultation questions, can be found in Chapter 6.

1.5 As this guidance applies across multiple infrastructure sectors, terminology used by providers may differ. For consistency, this document uses the term 'infrastructure provider' to refer broadly to the organisations responsible for planning, investing in, and operating infrastructure assets and networks, unless otherwise specified.

Context for this guidance

Industry recognised standards

1.6 This guidance aims to align with the International Standard for Security and resilience – Community resilience – Guidelines for infrastructure resilience (ISO 22372:2025). The principles and guidelines in the ISO 22372:2025 are intended to inform policies, strategies, and regulatory frameworks that are based on evidence of risks and the vulnerabilities of infrastructure. It aims to help decision-makers and provide options to improve infrastructure resilience against clear goals while strengthening governance and assurance.

1.7 Our guidance therefore intends to complement ISO 22372:2025 by providing additional information and outlining what we consider 'good looks like' in practice when it comes to resilience investment decision making. As infrastructure providers increase the maturity of their resilience planning and investment, we would expect them to progressively work toward meeting the ISO 22372:2025 standard.

1.8 ISO 22372:2025 provides a comprehensive overview for infrastructure resilience by setting guidelines for establishing, maintaining, monitoring and improving infrastructure resilience. As our guidance document is more narrowly focused on the investment decision-making process for resilience related investments, we have specifically considered 6.3 Plan: investing in infrastructure resilience and 6.4 Do: devising and designing ways to improve infrastructure resilience.

Resilience vs Reliability

1.9 For the purposes of this guidance document, we have defined 'infrastructure resilience' in this context as '*the timely and efficient prevention, absorption, recovery, adaptation and transformation of national infrastructure's essential structures, functions, and services, which have been, or will be, exposed to current and potential future hazards'*.

1.10 Resilience in this context is therefore differentiated from reliability, which we define as *'the probability that a system will perform its intended functions without failure, within design parameters, under specific operating conditions, and for a specific period of time'*.

1.11 This guidance is focused on improving infrastructure providers' approach to investing in *resilience* by undertaking a structured and thorough investment decision-making process. We expect infrastructure providers to provide a *reliable* service as part of their day-to-day functions.

Roles in resilient infrastructure

1.12 Achieving infrastructure resilience is not the responsibility of one organisation or business alone. There are many different organisations, each with their own responsibilities and roles in the system. Understanding the different roles is important when coordinating between parties and assessing the interconnections in the system. We have included below some of the key roles and responsibilities in infrastructure resilience, taken from the ISO 22372:2025.

1.12.1 Operators identify the most critical components / sub-systems to service delivery.

1.12.2 Owners and insurers identify costs and assess risk and returns.

1.12.3 Financial partners identify and develop mechanisms of funding and financing.

1.12.4 Academia provides theories, concepts and insights on hazards, risk, vulnerability, resilience and management options.

1.12.5 Government considers alignment with policy and long-term public goals.

1.12.6 Regulators facilitate and manage the prioritisation and recognise trade-offs within their statutory roles.

The role of the Commerce Commission in resilience

1.13 The Commerce Commission regulates various infrastructure providers and carries out sector-specific functions under the Commerce Act 1986, the Telecommunications Act 2001, and the Local Government (Water Services Preliminary Arrangements) Act 2024.

1.14 Our role at the Commission is guided by this legislation, with the overarching purpose of ensuring infrastructure providers are acting for the benefit of their consumers within the relevant legislative frameworks. For price-quality regulated businesses, resilience investment would be considered during resets of default price-quality paths (DPPs), certain reopener applications, or customised price-quality path (CPP) assessments. For infrastructure providers subject only to information disclosure, ID requirements do not explicitly prescribe how resilience investment should be reported. However, we would expect that relevant aspects of resilience planning and investment are reflected in disclosures, in a way that is consistent with the nature of the supplier, the risks faced, and the decisions being advanced.

1.15 Building and maintaining a resilient network is critical to providing the level of service consumers expect, at a price that is reasonable and efficient over the long term. Importantly, in this context 'efficient' means efficient service delivery for consumers over the long term, taking into account relevant statutory and regulatory obligations on suppliers, including obligations relating to public health, environmental performance, and service continuity.

1.16 We are publishing this guidance document to support proactive resilience decision making consistent with the legislative and regulatory frameworks under which these services are provided. Our intention is to assist infrastructure providers to better anticipate and adapt to hazards, and invest in ways that reduce the likelihood and impact of service disruption, while remaining consistent with these frameworks, so that essential services remain available when they are needed most.

ResOrgs Report

1.17 The resilience principles outlined in this document were developed and provided to us in a report from resilience experts ResOrgs[1]. We have taken these principles, set out examples to illustrate their application in a range of contexts, and provided guidance on what we expect to be undertaken and provided in relation to resilience investment decision making. The ResOrgs report is published alongside this guidance document, and we welcome feedback on the report itself (in addition to this document) through the consultation process.

[1] ResOrgs, 'Infrastructure Resilience - Key principles for regulating the performance of utilities. Prepared for Commerce Commission, August 2025.

Resilience in infrastructure decision making

1.18 Infrastructure resilience is multi-dimensional, extending beyond asset hardening to encompass service delivery, organisational capacity, and community and business preparedness. Considering infrastructure resilience is not a standalone add-on exercise, but should be integrated into ordinary asset management, risk management, governance, organisational capacity and investment planning. There are many ways to achieve resilience, including through service design, operational capability, preparedness and investment choices, which extends beyond just physical system improvement (such as asset hardening). Effective resilience investment prioritisation depends on a clear consumer and service delivery focus rather than solely asset management-focused solutions.

1.19 Thinking specifically within a utility, the ResOrgs report outlined four key areas that can impact the resilience outcomes of their service:

1.19.1 **Organisational resilience** – the capacity of infrastructure operators to effectively plan for and respond to disruptions, including financial health, staff capability, leadership, and business continuity management.

1.19.2 **Information and planning systems** – the availability of adequate hazard data, risk analysis processes, and investment analysis capabilities to determine minimum investment levels for resilience improvements.

1.19.3 **Physical system attributes to withstand an event and minimise damage and disruption** – the physical attributes of infrastructure networks that reduce damage during events or enable rapid restoration, including asset robustness, network redundancy, and emergency response provisions.

1.19.4 **Investment decision making** – robust financial decisions based on recognised processes and techniques that ensure financially sound and well-prioritised investments.

1.20 This guidance document focuses on the last area, investment decision making, as an initial stage of work on resilience by the Commission. The other three areas are critical for overall business resilience and readiness and should be considered by every infrastructure provider. Effective planning and understanding system attributes will play an important role in, and should feed into, resilience investment decision making. If an infrastructure provider wants some examples or resources to consider or implement the other areas, or to understand the wider resilience context for this guidance please see the links in the additional information in Chapter 5.

Chapter 2 Resilience principles for investment decision making

Overview of this chapter

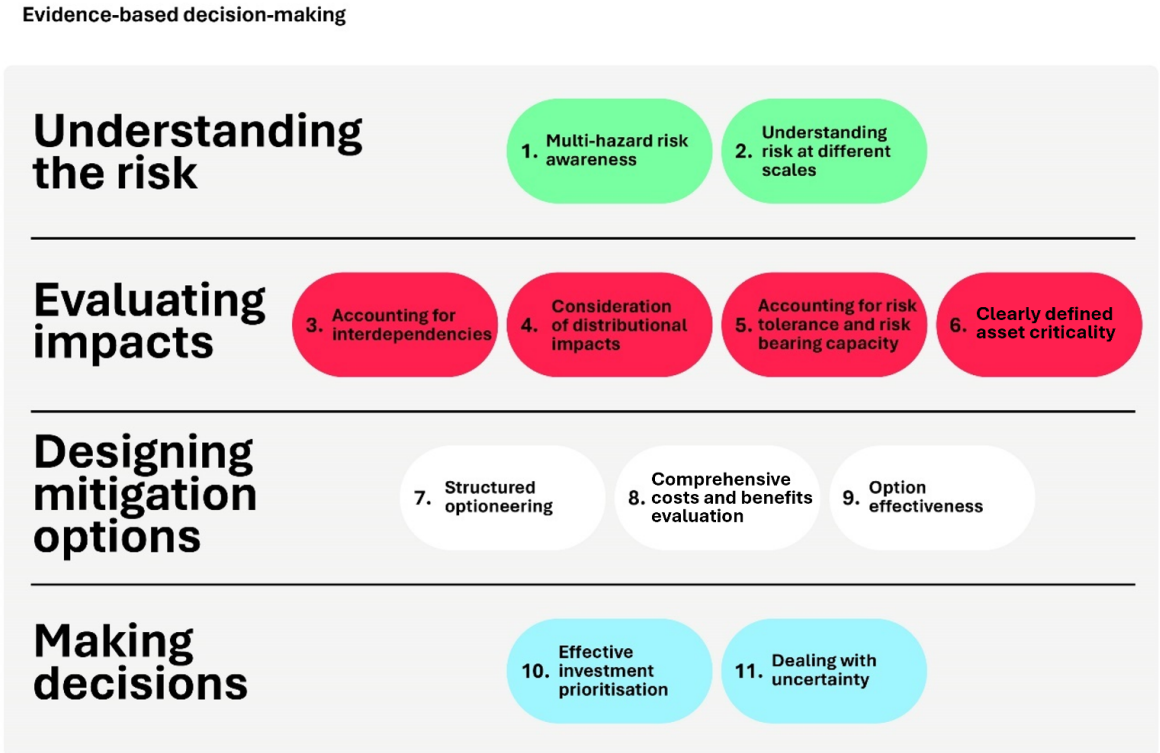
2.1 This chapter outlines the key principles that we recommend infrastructure providers consider in their resilient infrastructure investment decision making.

2.2 These principles are founded on a philosophy that infrastructure investment and planning should be based around an understanding of the infrastructure network, its users, and its deficiencies, not around single projects addressing singular issues. A wider system view is required to inform decisions and develop options and actions that provide both direct and indirect benefits to consumers and communities.

2.3 Figure 2.1 summarises these principles, which are discussed in more detail throughout this chapter. They are organised into four groups that broadly align with the key stages of a robust decision-making process, and presented in these groups in this chapter.

2.4 Taken together, the principles provide a fulsome picture of what is required to undertake a comprehensive resilience evaluation, and reflect our expectations of mature practice. We recognise that fully evaluating and accounting for these concepts may require capability development for some infrastructure providers.

Figure 2.1 Overview of evidence-based decision-making principles



2.5 For providers at an early stage of their resilience journey, we would expect to see evidence that some of the key principles are already being considered in their decision-making processes. As resilience investment planning matures, all of the principles should be evident and the concepts considered in more detail. We expect this transition to more mature practice to occur within a reasonably short timeframe, with a clear direction of travel toward full application of these principles.

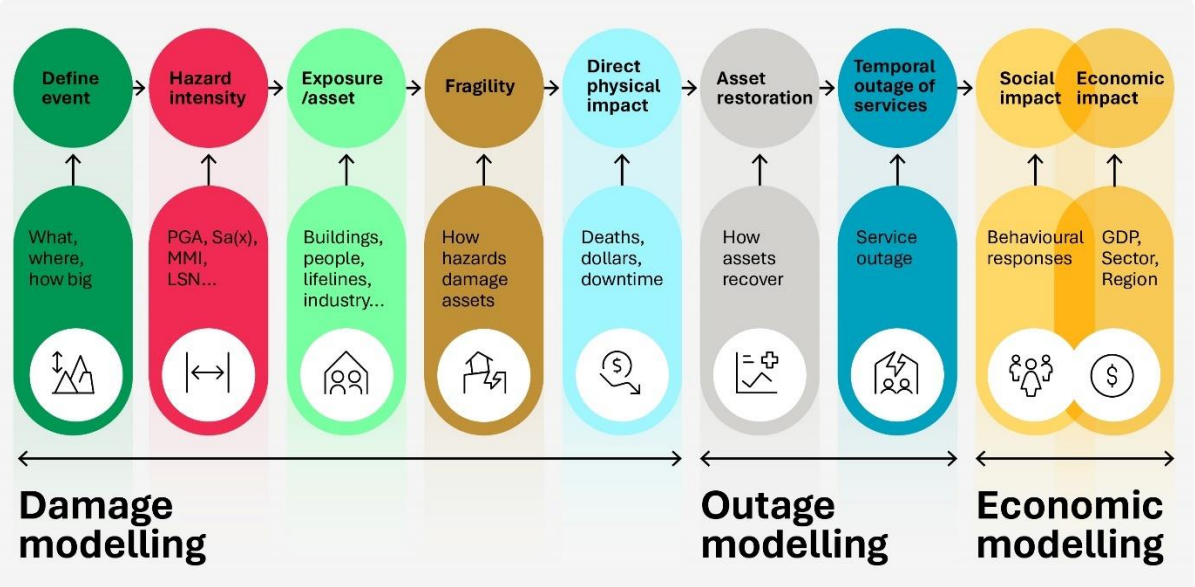
Evidence-based decision making

2.6 The rationale for adopting evidence-based investment proposals is to ensure decisions are grounded in accurate and relevant information, leading to more effective and efficient outcomes that deliver long-term benefits for consumers.

2.7 Investment needs should be substantiated by valid, fit-for-purpose data and analysis, with confidence levels and data uncertainty explicitly acknowledged. The level of analysis, modelling and documentation expected should be proportionate to the scale, cost, uncertainty and consequences of the proposed resilience investment. The expected quality and robustness of evidence should increase with the significance of the risks to service, consumers and communities.

2.8 A basic risk assessment involves the evaluation of the hazard, likelihood, asset exposure, asset vulnerability, direct impacts (e.g., to fixed assets and connecting networks that impact consumers) and indirect impacts (e.g., indirectly through loss-of-service). Figure 2.2 shows the key technical steps followed in a risk assessment, with each step building on previous steps, but also requiring its own evidence base.

Figure 2.2 Risk assessment modelling process



1. Understanding the risk

Principle 1: Multi-hazard risk awareness

2.9 Investment decisions must look across hazards, severities, and timeframes rather than focusing on single threats in isolation. This includes considering both acute shocks (earthquakes, floods) and chronic stressors (climate change, demographic shifts).

2.10 For systems where there is a high resilience maturity, investments should consider not only isolated single hazard risks, but repeated events and multi-hazard events, where perils occur simultaneously (i.e., at the same time) or potentially trigger cascading secondary hazards.

Example

An infrastructure provider may have an asset in a flood prone area that has been impacted by a recent flooding event. When considering the options to prepare for a future similar event, the infrastructure provider should assess what other hazards are likely before making an investment decision solely based on flood protection alone. Questions to consider for multi-hazard awareness could be:

- *Is the asset vulnerable to other hazards?*
    - *Earthquakes, fires, landslides, high wind, storm surge, tsunami? Map out the likely natural hazards the asset will be vulnerable to that should be considered in the decision-making process.*
- *Could any of those hazards occur simultaneously?*
    - *Flooding might occur at the same time as high wind and landslides due to an extreme weather event. If simultaneous hazards are likely, options should be considered that could withstand or respond to those hazards occurring at the same time.*
- *Which hazards could be cascading or sequential?*
    - *An earthquake might trigger a landslide into a body of water, which could then create a localised tsunami risk.*

The key point in this step is to increase awareness to the likely hazards. The preferred investment option may not need to address all hazards identified, but it is important to consider the range of likely hazards in the decision-making process.

What we expect to see

When undertaking a multi-hazard assessment (e.g., across the whole network or in targeted areas), we would expect to see evidence of multi-hazard forecasting. This involves quantifying the likelihood of any hazard occurring and then estimating the likelihood of hazards occurring at the same time or close together. This should be through a structured framework and include the likelihood, probability, magnitude, and consequence of the hazards. Good practice is to demonstrate these multi-hazards across the network area using Geographic Information System (GIS) layers.

Principle 2: Understanding risk at different scales

2.11 Hazards and their impacts vary across space, time, and affected populations, requiring analysis at multiple scales. Risk assessments should account for both high-impact low-probability events and low-impact high-probability events, while recognising that impacts are not experienced uniformly across consumer groups.

2.12 Rural, isolated and often Māori communities may experience the same outage very differently because of remoteness, weaker baseline infrastructure, fewer alternatives, and greater dependence on local support networks. This includes where local capability is already carrying part of the resilience burden when formal services fail.

2.13 In addition, risks assessment through a consumer lens should also account, where possible, for known uncertainties using sensitivity analysis or decision-making frameworks and evaluation tools and techniques which deal directly with uncertainty. These tools and frameworks are covered in more detail in Chapter 4.

Example

Infrastructure providers should consider hazards across all likelihoods and impacts, including:

- *High-impact, low-probability – high impact weather event, high magnitude earthquake, tsunami, large wild-fire, cyber-attack, pandemic.*
- *Medium-impact, medium-probability – storm with high rainfall or wind, storm surge, lightening, localised fire event.*
- *Low-impact, high-probability – periodic flooding in flood prone areas, climatic shifts from climate change, smaller weather event (especially in exposed places), human impact (e.g., copper theft, traffic accident).*

Time and frequency of exposure should be considered – for example, assets closer to the coast or exposed to the prevailing wind in a high wind speed area might experience more impact from regular weather events (i.e., a chronic hazard).

Assessing impact then considers how communities and consumers are affected.

- *What is the size of the impact?*
  - *Consideration should be given to the number of consumers affected in the given area, or the value lost from disruption (e.g., high value output in an industrial area).*
- *Which communities will be more vulnerable to the same hazard event? How well will they be able to respond to the impact?*
  - *Better prepared communities might have more resources or alternative supply sources (e.g., solar and battery systems) to last without power following an event compared to those with low preparedness or no access to alternative supplies. Thought should be given to how resilience investment might target or prioritise the more vulnerable communities.*

    - *Communities exposed to multiple hazards (e.g., exposed to high winds, coastal flooding and landslips) might experience poorer quality of service over time.*
    - *Remote communities might have fewer access routes and could be more easily cut off.*
- *Which consumers across your network are dependent on your service for health or safety reasons?*
- *Which businesses, organisations or public services do you have in your area on what is their risk exposure? Hospitals, retirement homes, food storage businesses.*

What we expect to see

We would expect to see analysis of hazards at different scales applied to the critical assets being considered for replacement.

For technical analysis this should use appropriate tools, for example GIS modelling to show flood levels for a 1/100-year flood, a 1/250-year flood and then a 1/500-year flood via different layers. This would be used to assess the potential impact to the assets across the network.

An important assessment we would also expect to see is the impact to consumers and communities. This should cover the different scales of a possible event. For example, identifying the number of consumers likely to be affected, the expected duration of disruption, and the availability of community or local resources to support consumers while services are restored.

We would expect this assessment to go beyond desktop analysis. Where vulnerabilities are potentially material, this should include targeted engagement with affected communities and iwi, hapū and Māori, where relevant, to test assumptions about likely impacts, local capability, and interim support.

We would also expect consideration of information held by CDEM groups, Lifelines Groups, emergency responders, and other relevant agencies to inform understanding of isolation risks, access constraints, restoration priorities, and the availability of interim support. This should include assessing whether apparent community resilience is masking underlying weaknesses in formal service resilience.

2. Evaluating impacts

Principle 3: Accounting for interdependencies

2.14 To enable the realisation of investment benefits, investment proposals should be tested to ensure that they appropriately account for critical infrastructure dependencies. Modern infrastructure systems (energy, transportation, water, communications, etc.) are highly interdependent, meaning the operation of one system often relies on others and the failure of one can materially worsen service impacts in another.

2.15 These links mean that a disturbance in one infrastructure may cascade into failures in other systems, potentially escalating a localised incident into a wider crisis. Understanding these dependencies may be important to the creation of resilience.

2.16 A well-established classification identifies four primary types of interdependencies based on the nature of the connection:

2.16.1 **Physical interdependency** - the output of one infrastructure is a physical input to another.

2.16.2 **Cyber interdependency -** the state of one infrastructure depends on information transmitted via information and communication technology (ICT).

2.16.3 **Geographic interdependency -** infrastructure components are co-located and exposed to shared hazards.

2.16.4 **Logical interdependency -** organisational or policy-based relationships that influence operations across systems.

Examples

*Physical interdependencies **could be:***

- *Telecommunications and the electricity network - during an event, faults to the electricity network will need to be fixed before telecommunications can be restored.*
- *Roading / access is required before crews can be on the ground to restore affected assets (water, electricity, fibre etc).*
- *Within a specific sector – for example, within the telecommunications sector there are connections between fibre and fixed wireless, or between low earth orbit telecommunications and ground stations.*

*Cyber interdependencies **could be:***

- *Electricity network and low-voltage network data from network devices and smart meters – to determine where faults lie in their network, many electricity lines businesses are using smart meter data. A fault of temporary loss of this IT system would impact the EDB's visibility across its network.*
- *Water service providers rely heavily on telemetry and Supervisory Control and Data Acquisition (SCADA) systems to monitor and control critical assets such as treatment plants, pump stations, reservoirs, and pressure zones. These systems are often dependent on telecommunications networks, data centres, cloud services, and electricity supply.*

*Geographic interdependencies **could be:***

- *Power poles also containing telecommunications connections.*

- *Electricity transmission and distribution assets, gas pipes, airports and waste and drinking water connections all being located on the same fault line or flood plain.*
- *Remote communities with a single point of access (ie, a bridge, road or airport) – all utilities within that area are reliant on that access route.*

Logical interdependencies ***could be:***

- *During an extreme event, there will be many logical interdependencies between central agencies (e.g., NEMA), local agencies (e.g., councils, first responders) and communities on the ground. Critical infrastructure providers building connections with these groups prior to extreme events will be critical to ensuring responses run effectively.*
- *When considering new investment or upgrades, there may be many policy dependencies – ie, consent processes, local government planning rules, capacity considerations for infrastructure networks (e.g., electricity or wastewater).*
- *Logical interdependencies also includes governance and regulator interdependencies. In practice, resilience outcomes may depend not just on the infrastructure provider's assets and systems, but on how the provider, the Commission, other regulators (e.g., Electricity Authority or Taumata Arowai), regional councils, territorial authorities and emergency management settings interact. Constructive cross agency and regulator engagement is needed to support efficient resilience outcomes.*

What we expect to see

When considering investment for hardening infrastructure, we would expect to see an assessment and mapping of the estimated impact to other interdependencies. The impacts or losses incurred by other interdependencies should be included in the commercial assessment, including where those impacts fall on other essential services, emergency response, or communities with limited alternatives.

Principle 4: Consideration of distributional impacts

2.17 Infrastructure investment decisions should consider the effects on different types of consumers and communities to consider that existing social inequities are not exacerbated. This consideration can factor into both the investment option or funding options identification process and the review of modelling and value estimate results and limitations.

2.18 Impact evaluation needs to identify the range of impacts across economic, natural, social, and human domains. This includes both direct impacts (e.g., asset damage, immediate service loss) and indirect (or 'higher-order') impacts (e.g., supply chain disruptions, ecosystem service interruptions, flow on effect from loss or reduction of income during a peak time).

Example

One community might be willing to pay more for a more reliable service due to higher disposable income. However, it should not be assumed that investments to that area are inherently of greater value than in other communities. Consideration should also be given to the impacts on communities and their ability (or lack of ability) to respond to and cope with loss of power, internet, water, and other essential services. Willingness to pay may not align with need, particularly where service failure has direct health and sanitation implications.

Business and industrial consumers relying on essential services should also be considered. Small local businesses, or those with perishable items might be less able to withstand extended outages than other industries.

Cultural and community-specific factors are also important. Relationships should be established and engagement should be undertaken with local iwi, hapū, and community groups to understand local needs, areas of vulnerability, existing resilience initiatives and the role of marae and other community infrastructure in supporting responses and recovery.

Effective consumer and community engagement is central to this principle. Communities that appear resilient due to self-provisioning (e.g., through generators, water tanks, batteries, or marae support) should not automatically be taken as evidence of strong infrastructure resilience where this reflects a need to compensate for unreliable or under-invested networks. In such cases, this analysis should identify where service failure would impose disproportionate burdens on rural, isolated, lower-income, or otherwise more exposed communities, including where households, marae, iwi, or local organisations are required to absorb part of the resilience burden.

What we expect to see

We expect to see that the infrastructure provider takes on leadership and co-ordination to understand the impact of the loss of service to different consumers in the community and how they may or may not manage with that loss of service. It may not be the responsibility of the infrastructure provider to implement or pay for any resilience investment. Demonstration of this principle could be through GIS layers showing the impact, an impact assessment undertaken on the geographical areas that are expected to be impacted, or through different values for those affected by the loss of infrastructure.

Where distributional impacts are material, we expect infrastructure providers to have evidence of targeted engagement with affected communities, including iwi, hapū, Māori, and other relevant groups, and, where appropriate, to coordinate that engagement with other affected providers.

Principle 5: Risk tolerance and risk-bearing capacity

2.19 Community perspectives on acceptable risk levels and desired service standards should inform investment priorities, recognising that different communities have varying needs and expectations

2.20 Assessments should capture both what consumers want (risk tolerance) and what they can cope with (risk-bearing capacity), recognising that these are not always aligned. They should reflect the diverse needs of different consumers, including across industry sectors, households, communities, and regional or geographical contexts. Care should be taken to not rely on willingness to pay alone as this may reflect constrained means rather than lower need or exposure. In particular, willingness to pay should not be treated as a proxy for need where risk-bearing capacity is low and the consequences of service failure are significant.

2.21 Risk tolerance preferences can be established through consumer consultation, social impact assessments, surveys using stated preference techniques, or economic analysis. Risk tolerance is dynamic through time. As a result, it is something that needs to be monitored and subsequent risk management decisions adjusted over time.

Example

Continuing the example under distributional impacts above, the better prepared community might appear to have a lower risk tolerance for electricity outages than a less prepared or more vulnerable community if surveyed on willingness to pay alone. However, if the two communities' risk bearing capacity is considered, the well-prepared community might have a greater ability to withstand an electricity outage (solar/battery storage or generators, better quality housing to maintain heat).

Geographical factors might also influence risk tolerance and capacity. More remote communities might have developed a higher risk tolerance over time and subsequently a greater risk bearing capacity. For electricity supply, if there are long lines to connect the community to the network that have a high frequency of being impacted by falling trees, members of the community might prefer to invest in community or personal supply options (e.g., solar and battery storage or generators) compared to paying for storm-hardening of the electricity network.

To be effective, it is important that community engagement considers both risk tolerance and capacity, and to account for these to change over time. This means that re-consultation or ongoing engagement might be necessary, depending on the infrastructure investment.

The Natural Hazards Commission has produced a Risk Tolerance methodology (see here) which can be used to help integrate risk tolerance consideration in the decision-making process. Please note this is just an example provided, not a requirement to use that specific methodology.

What we expect to see

Where investment is being undertaken, we would expect to see evidence that infrastructure providers have engaged with communities to determine the risk tolerance (willingness to bear risk and pay) for the area that is impacted and follow a risk assessment international standard approach such as ISO 31000.

Where investment results in a significant increase in charges to consumers, we expect to see a higher level of engagement and analysis to be undertaken, including consideration of risk-bearing capacity and whether willingness to pay diverges from need or exposure.

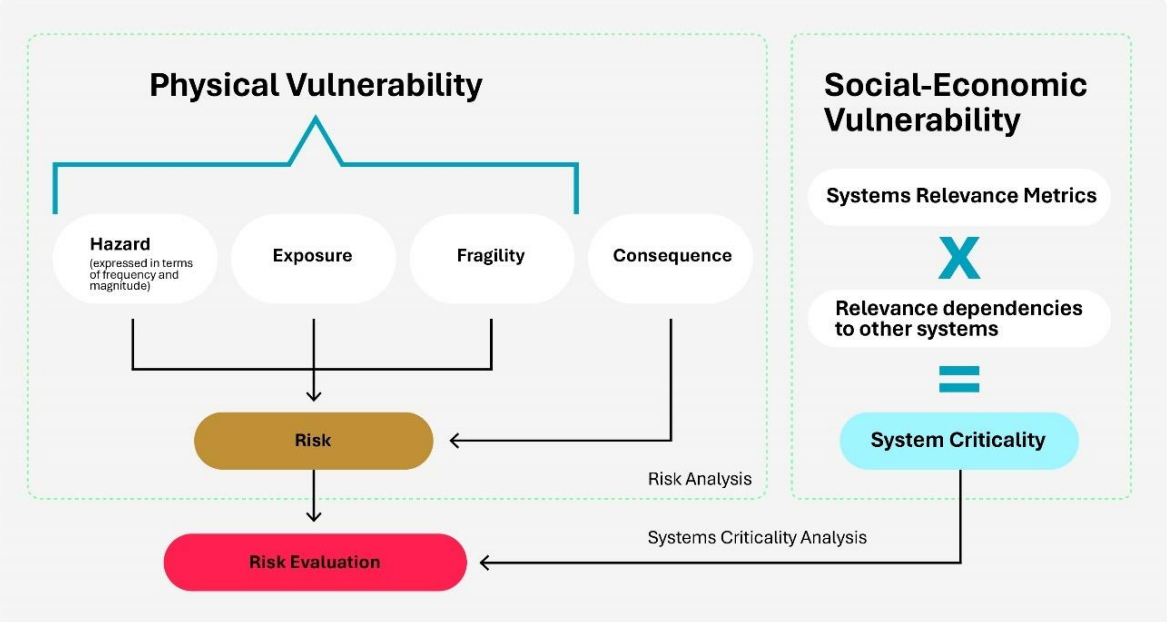
Principle 6: Clearly defined asset criticality

2.22 Infrastructure asset criticality is a useful concept to understand the relative benefits of investment in different aspects of a critical infrastructure network. Understanding the relative importance of infrastructure components, based on consequences of failure during both normal operations and emergency response, enables targeted investment prioritisation.

2.23 Criticality assessments combine physical vulnerability with socio-economic impact to identify where resilience investments will provide the greatest benefit to the consumer. Assets with higher criticality will have a greater impact if they are disrupted.

2.24 Dependence on other essential services, public health, environmental harm, social and cultural impacts can make an asset highly critical even where the immediate asset or revenue impact looks smaller.

Figure 2.3 Criticality risk analysis



2.25 Figure 2.3 shows an example of how a criticality risk assessment could be undertaken, looking at physical vulnerability and the socio-economic vulnerability. Criticality can also evolve over time, and change can occur without physical change to the asset (e.g., due to new legislation or changes in iwi or community reliance). The frequency of criticality assessments should be taken into account to ensure the information remains relevant.

Example

Using the criticality risk assessment analysis model in Figure 2.3, an asset that would be labelled high criticality might be:

- *Exposed to multiple hazards e.g., located on or near a faultline, have high landslide risk nearby, exposed to high prevailing winds, in a flood prone zone, near the coast/at risk for storm surge; and*
- *Some of those hazards would have a high frequency (e.g., high winds) and/or a high magnitude (e.g., near the Alpine Fault line with a chance of rupturing at magnitude 8 or higher); and*
- *Assets have not received recent upgrades or reinforcements, resulting in a high fragility / likelihood of failure (e.g., electricity poles tagged for replacement in the next 2 years); and*
- *Provides a service to a high percentage of the population (e.g., electricity or water supply to a central city area), meaning that a failure or loss of service would affect a high number of consumers; and*
- *There is no back-up option available for the asset (e.g., a high single-point-of-failure risk); and*
- *The area affected contains vulnerable communities exposed to multiple hazards (e.g., a low decile area which is also flood prone and susceptible to landslips); and*
- *The asset connects to other critical infrastructure assets (e.g., electricity connection into a wastewater treatment plant).*

Assets might have one or a few of these factors apply to them, however, it is the combination of multiple factors that increases the criticality of an asset.

What we expect to see

For significant resilience investments, we would expect to see evidence that asset criticality has been applied in accordance with good industry practice. The analysis should apply evaluation criteria that results in an assessment or ranking of the assets that are critical to the end consumer and take account of potential adverse environmental and/or cultural impacts arising from service failure or disruption.

Organisations can demonstrate asset criticality through the publication of an asset criticality framework or the use of an industry model. This could be published separately on their website or incorporated into the provider's Asset Management Plan.

3. Designing mitigation options

Principle 7: Structured optioneering

2.26 A critical part of an effective investment case is the development of a wide range of clearly defined and considered options. Rather than converging too quickly on a single preferred option, optioneering encourages a structured approach: defining objectives, identifying a broad range of options (including the 'do minimum' or 'do nothing' options), assessing each against consistent criteria, and justifying the final selection with a depth of analysis proportionate to the significance of the proposed investment.

2.27 For infrastructure investment, risk management strategies (to be used when undertaking optioneering) are:

2.27.1 **Avoid** – relocate.

2.27.2 **Control** – harden and protect, or implement practices to restore services (e.g., store spares).

2.27.3 **Transfer** – transfer some or all of the consequences of a hazard to another party, for example through insurance or contractual arrangements. This can complement other risk management strategies.

2.27.4 **Accept** – accept or abandon.

2.28 Options development should also consider wider issues and opportunities, such as:

2.28.1 Interventions with co-benefits (e.g., the use of solar for resilience purposes also reduces the carbon footprint);

2.28.2 Climate change investments;

2.28.3 Adaptable solutions;

2.28.4 Emerging technology;

2.28.5 Decentralised solutions;

2.28.6 Alternative service options; and

2.28.7 Consideration of who is best placed to manage / deliver the resilience outcome.

Example

An asset has been identified as requiring replacement. An investment option needs to be selected. Instead of simply replacing like for like, we would expect that a range of options are considered in the decision-making process.

- *Avoid – is the location of the asset still appropriate, or is there another location that would have less hazard exposure? For example, relocating an asset out of a flood prone area or more in-land to protect from coastal weathering. It might cost more to move the asset, however the benefits from the new location could out-weigh the costs from remaining in the same place over the long term.*
- *Control - does the asset need to be rebuilt, or are there options to harden or protect it instead? The full investment might not be necessary if the asset is not critical or a larger upgrade might be able to be deferred via the use of an alternative solution. Rebuilding or hardening the infrastructure that protects a critical asset could also be more cost effective that relocation – for example, hardening a sea wall to protect an airport runway instead of relocating the airport.*
- *Transfer – can the risk and some consequences of failure be managed by another party? For example, a third party could be contracted to provide the services and manage the risk. Financial risk and consequences may also be partially transferred through insurance. Depending on the circumstances, this approach may be more cost-effective than investing directly in additional assets or capability.*
- *Accept – the costs of investment outweigh the benefits, and therefore the risk on the asset is accepted. No action is required, and upon failure the asset may be abandoned.*

Once the options for the asset are identified, each option should also be assessed for the additional issues and opportunities outlined above. For example:

- *Shifting location of the asset might result in it being supplied by a different part of the electricity network that has a greater capacity, and could result in a different asset being built.*
- *The asset is not at risk from current sea level, but it has a lifetime of 50 years and may be at risk from future sea level rise.*
- *A number of houses in the community have solar installed on their homes and would prefer investment into a community battery they could charge instead of hardening the lines network.*
- *As an example from a different sector, building a second taxiway at an airport could serve as a back-up runway if the main one was flooded or damaged.*

What we expect to see

Where there is significant investment for infrastructure resilience, we would expect to see the infrastructure provider's analysis and assessment of a wide range of options and the reason for considering or discounting each option.

We would expect this to include consideration of whether the resilience outcome is most efficiently delivered through the infrastructure provider's own investment, through coordination with other providers or agencies, or through another solution better suited to the circumstances.

Principle 8: Comprehensive costs and benefits evaluation

2.29 An infrastructure investment option will have a variety of impacts or outcomes; we often refer to these as the 'costs' and 'benefits'. Costs and benefits can span economic (e.g., new capital outlays, reduced risks of asset damage and business interruption), natural (e.g., alteration in pollution, biodiversity, amenity/landscape values), social (e.g. alteration in neighbourhood amenities and community connectedness), and human (e.g. incidences of disease and mortality) domains. To effectively make investment decisions, a wide range of costs and benefits needs to be identified and weighed up.

2.30 Linked examples and guidance on undertaking a cost-benefit analysis can be found in Table 4.1 in Chapter 4.

What we expect to see

For significant resilience investments, we would expect infrastructure providers to have undertaken a comprehensive cost-benefit analysis, consistent with Social Cost benefit analysis (see Table 4.1). This analysis should compare options across their economic, environmental, social, and cultural impacts and benefits to the communities and consumers who bear the cost of the investment.

The level of detail in this analysis should be proportionate to the size of the investment:

For larger or more complex investments, we would expect to see analysis applied at a regional or network level, using appropriate frameworks such as real options analysis, multi-criteria analysis, or approaches such as MERIT.

For smaller investments, proportionate application of established frameworks, such as the Treasury's Better Business Case guidance, would be appropriate, including clear consideration of material service and community impacts and benefits.

Principle 9: Options effectiveness

2.31 The effectiveness of options needs to be considered from both a cost perspective (e.g., a benefit-to-cost ratio) and the timing of an investment (optimal timing of intervention).

2.32 Long-term considerations are critical, as initial investment choices constrain future options, and changing conditions affect when interventions deliver maximum value. For example, if the flooding risk increases with climate change, the benefit-to-cost ratio for resilience investment rises accordingly.

Example

The timing and trade-off of capital expenditure (capex) and operational expenditure (opex) solutions should be considered in options effectiveness.

For example, in managing vegetation risk to electricity lines, an opex solution (such as tree removal) may provide a lower-cost or more efficient option in the short term compared to a traditional capex solution (such as asset replacement or hardening). Over time, however, as demand or hazard risk increases (for example, more frequent high wind events or rising water levels), the benefits of a capex solution might start to outweigh the costs and become the appropriate intervention.

Approaches such as adaptive pathways or trigger-based decision making (discussed further under Principle 11) can be used to assess how the timing and effectiveness of options may change for long-lived, climate sensitive assets.

What we expect to see

When considering different options, an appropriate level of optionality is expected to be considered relative to the size of the possible investment. Options are expected to be clearly outlined, compared against one another, the optimal timing for each option considered, and the reasons for discounting them documented.

The options we would expect to see considered are from do nothing and accept the risk, insure against the losses, prepare for recovery from an event, and different hardening options. For significant investment, we expect the infrastructure provider to compare hardening assets against different return periods. For example, hardening for a 1/100 year event and a 1/500 year event should be included in the cost benefit assessment, and options that could be more beneficial in the longer term and life of the assets.

4. Making decisions

Principle 10: Investment prioritisation

2.33 Coordinated network optimisation, which emphasises the strategic prioritisation and scheduling of infrastructure projects, is an effective way to maximise interconnectivity and system-wide resilience. Project prioritisation is important both within a given organisation's investment programme and also across different utilities.

2.34 Recognising infrastructure as a system-of-systems allows for more efficient sequencing of projects, creates redundancy, readily enables rapid recovery to disruptive events, and ensures infrastructure supports broader economic and social resilience. By embedding multi-sector dependencies into infrastructure investment frameworks, decision makers can foster a more robust, interconnected system that remains functional and efficient under stress, ultimately safeguarding household/business consumers and realising benefits across utilities.

2.35 Stakeholder and consumer engagement also has a role in investment prioritisation. Effective engagement can provide a greater understanding on the level of risk (including risk tolerance), help evaluate trade-offs and can identify potential or preferred solutions.

Example

Investment decisions should be considered within the infrastructure provider's own prioritisation processes or frameworks (e.g., consideration to reprioritise investment in high criticality assets).

Decisions should also be prioritised and considered alongside other sectors. For example, an upgrade to a roading network provides an opportunity to improve access to electricity, telecommunications, fibre and water pipe upgrades. Taking advantage of cross-sector coordination can save overall costs to each infrastructure provider but also to the end consumer.

What we expect to see

Prioritising asset investments is fundamental to asset management of any type of infrastructure asset. For resilience investment, we expect infrastructure providers to demonstrate prioritisation processes that consider risk profile, criticality, consumer/community requirements, return on investment, disruption and service dependency.

We also expect providers to consider prioritisation in a broader system context, including coordination with other infrastructure providers, local authorities, Lifelines Groups and communities, where appropriate to achieve efficient and effective resilience outcomes.

Through this engagement, providers should identify where iwi, hapū and communities contribute to resilience, where service failures may have higher social or cultural consequences, and where disruption is repeated or compounding, and reflect these factors in prioritisation decisions

Principle 11: Dealing with uncertainty

2.36 Uncertainty is inherent in any risk assessment, data analysis (including data quality and availability) and subsequent investment decision related to resilience. There is uncertainty in the timing and physical impact of a hazard, our vulnerability to hazards is likely to change over time (as our climate, technology, population and our economic, social and political systems change), and the likely behaviour or response of individuals to events. As a result, precise quantitative evaluation of options and their benefits can be misleading.

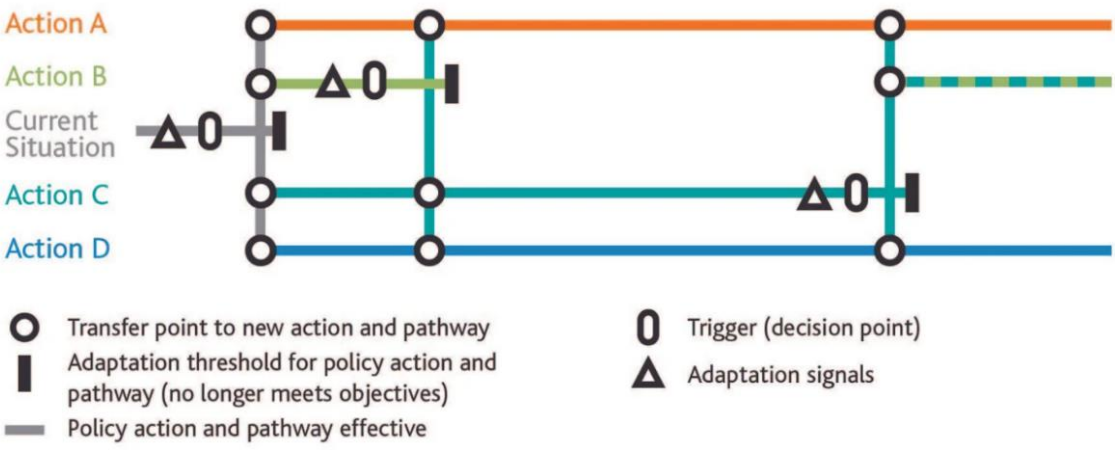
2.37 Uncertainty needs to be acknowledged and accounted for to ensure that investment decisions reflect uncertainty in expected value to consumers, and that utilities are appropriately managing risks to their operations. Appropriate techniques include sensitivity analysis for well-defined systems, scenario testing for systemic uncertainties, and adaptive planning approaches (real options analysis, dynamic adaptive pathways) for deep uncertainty contexts. Examples for these techniques can be found in Table 4.1 of Chapter 4.

Example

Consider the example of an infrastructure provider wanting to consider the impacts of climate change, specifically flooding risk, on assets in a flood prone area. To help consider options and when to choose them, they have chosen to undertake a Dynamic Adaptive Policy Pathways (DAPP) approach to deal with the uncertainty around timing of the impacts. This involves setting a series of triggers, at which point an action should be taken or alternative options should be considered.

For example, the main concern may be that the frequency of flooding from storm surges increases with sea level rise. The DAPP would help to set out the different possible actions (do nothing, harden the asset, rebuild a more flood resistant asset, relocate to an area that is no longer at risk from sea level rise). It would then set out trigger points, at which a threshold is met 'triggering' a different action to be taken. This helps to address uncertainty as the timing and pace of sea level rise do not need to be known, instead trigger points can be the indicator for action (ie, flooding occurs twice a year). By exploring different pathways and testing the consequences, the infrastructure provider can create an adaptive plan that includes a mix of short-term actions and long-term options.

The DAPP example is the image below is from the Auckland City Council .



What we expect to see

Where material uncertainty exists in future conditions (e.g. demand growth, asset condition, land access, consenting), we expect infrastructure providers to explicitly reflect this in their planning approach. This includes identifying credible alternative responses over time and structuring investment to remain flexible.

We would expect to see staged investment planning, with clear decision points (e.g. triggers or thresholds) that enable adjustments as conditions evolve, rather than committing prematurely to a single solution.

Chapter 3 What good looks like

Purpose of this chapter

3.1 This chapter outlines the indicators the Commission identifies as good practice – or 'what good looks like' - for infrastructure providers considering resilience investments. It builds on the principles in Chapter 2 by illustrating how our expectations can be evidenced in practice.

3.2 Table 3.1 links these indicators to the key questions under each of the principles in Chapter 2, providing a practical view of how robust resilience decision making can be demonstrated in different contexts.

3.3 We expect infrastructure providers to work towards good practice over time and to progressively achieve the baseline described in this chapter. We consider this to be part of usual business activities for a prudent and efficient provider. The pace and extent of progress should reflect the significance of the decisions being advanced and the scale of the risks being addressed. Over time, we would expect providers to demonstrate increasingly systematic and well-supported approaches to resilience investment as part of their normal asset management activities.

3.4 The indicators in Table 3.1 are not a checklist, but signal the types of evidence and approaches that exemplify good practice when applying the resilience principles in Chapter 2 to making robust resilience investment decisions.

Table 3.1 Indicators of what good looks like

Principle	Question	Indicators of what good looks like
1. *Multi-hazard risk awareness*	Are multi-hazard risks known and assessed?	- Hazard risks are identified documented in asset management or resilience improvement plans. - All hazards are incorporated in the risk assessment and assessed against the assets. - Quantitative assessment methodology is undertaken.
2. *Understanding risk at different scales*	Are risks assessed for different scales in asset planning and investment?	- Hazard risk assessments consider the risk at different scales. - GIS layers showing the impact to assets at the different scales. - GIS layers showing the impact to consumers at the different scales.

Principle	Question	Indicators of what good looks like
		- Targeted engagement with consumers, iwi, hapū and communities is undertaken to test consequences and risk where there is a significant resilience investment - Relevant place-based information from Lifelines Groups and utilities, NEMA or other local agencies is considered to understanding likely isolation, access constraints or restoration challenges.
3. *Accounting for interdependencies*	Are all the critical network infrastructure interdependencies understood? Do dependent organisations understand the dependencies? Are all economic interdependencies understood?	- The impact of loss of service to dependent agencies is documented and included in economic analysis. - Alternative supply options to provide services to dependent agencies have been discussed with relevant agencies and or service providers. - Dependencies are documented and contacts identified. - Cross-sector consequences for consumers and communities are considered, including where disruption in one service materially worsens impacts in another.
4. *Consideration of distributional impacts*	Has the impact to consumers bills been considered for all consumer categories. Eg; Residential, industrial, commercial, iwi. Has the impact of loss to different consumers been assessed?	- Infrastructure providers have categorised consumer types. - For affected consumer types, the infrastructure provider demonstrates the consumers' views on the loss impacts and willingness to pay for additional resilience. - Where distributional impacts are likely to be material, the infrastructure provider demonstrates how the impacts on more vulnerable, rural, isolated or otherwise exposed communities have been identified and assessed. - Where relevant, engagement with affected communities and iwi, hapū and Māori is used to inform the assessment rather than relying solely on desktop analysis.

Principle	Question	Indicators of what good looks like
5. *Accounting for risk tolerance and risk bearing capacity*	What impacts can or cannot be tolerated by the community that is impacted? What is the community appetite for risk?	- Infrastructure provider has a common framework for applying risk tolerance. - Significant investments are considered against the framework. - For significant investments, providers engage with those who are affected, communities, iwi, authorities, lifeline utilities. - Risk thresholds are determined for significant investments. - Assessment distinguishes between risk tolerance and risk-bearing capacity. - See the Natural Hazards Commission Risk Tolerance Methodology 2025 linked here.
6. *Clearly defined asset criticality*	Have assets that are at risk been objectively ranked for criticality?	- Infrastructure provider has a documented criticality framework, consequence x likelihood of failure, evaluated across safety, environmental compliance, customer impact and financial dimensions, as well as wider service dependency and relevant social or cultural consequences where material. - For significant resilience investments, the infrastructure provider has assessed the socio-economic impact on the community affected by the loss of critical assets. - Asset criticality is used and can be demonstrated for prioritisation of investment and recovery. - Asset criticality is applied to design standards and service levels.
7. *Structured Optioneering*	Has a structured analysis of possible options (including do nothing) been undertaken?	- A wide range of options are considered, eg. do nothing, minimal hardening to cover high return-period (ie. low probability) events, relocation, repair on loss, increase readiness, and insurance.

Principle	Question	Indicators of what good looks like
		- These options are assessed in a structured way against appropriate criteria. - This assessment should consider wider issues and needs, such as co-benefits, adaptability, decentralisations, serviceability and multiple hazard reduction.
8. *Comprehensive costs and benefits evaluation*	Has the cost-benefit analysis (CBA) considered all costs and benefits to consumers and the organisation?	- Use of a CBA framework appropriate to the size of the problem/ investment being addressed. - Cost and benefits are identified and assessed at a level of detail proportionate to the scale of the investment. - Impacts to communities are qualitatively assessed. - Impacts to other lifeline assets are considered. - Material service, community and cross-sector consequences of failure are reflected in the analysis.
9. *Option effectiveness*	Is there demonstration the investment achieves the maximum risk reduction for the investment at the right time? Does the investment mitigate the impact from multiple hazards? Is the investment scalable?	- Infrastructure provider has used an appropriate economic evaluation approach, such as cost benefit ratio, internal rate of return (IRR), net present value (NPV). - Timing of the investment options has been considered and demonstrated. - Scalability of the options is considered. - All options have been considered on cost and socio-economic benefits to the consumers being served.
10. *Effective investment prioritisation*	Has the organisation prioritised resilience investments? Does the investment prioritisation consider the value to other lifeline infrastructure?	- Organisations have documented prioritisation framework for resilience investment. - Multi-criteria analysis is applied, using costs, risk reduction potential, social impact and feasibility.

Principle	Question	Indicators of what good looks like
		- Prioritisation criteria for significant investments incorporate current and future impacts and burdens on community, iwi and hapū. - For significant investments, organisations have engaged with other lifeline infrastructure providers to develop prioritisation. - Resilience investment programmes are included in asset management plans, the infrastructure provider has engaged with impacted consumers, and the consumers' views are incorporated into the prioritisation.
11. *Dealing with uncertainty*	Has uncertainty in risk model assumptions been considered? Has scenario planning to investment options been undertaken? Is the level of uncertainty in the investment planning been considered and documented? Are the investment strategies adaptive to uncertainty?	- For significant investments and mature organisations, techniques are applied to review the uncertainty, such as Monte Carlo, real options analysis and dynamic adaptive pathways. - Uncertainty in assumptions is documented. - Scenarios are applied to investment options. - For investments that have high uncertainty, adaptive strategies are applied. - Management undertake regular reporting to board on risk exposure to hazards, impacts to business and customers and the level of uncertainty.

Chapter 4 Decision-making frameworks and tools

Purpose of this chapter

4.1 This chapter provides an overview of decision-making frameworks that can be used when considering investment in resilient infrastructure. The choice of framework will depend on the scale, materiality, uncertainty and maturity of the decision being advanced. This chapter summarises key characteristics to support infrastructure providers in selecting an appropriate framework for their context.

4.2 When evaluating resilience investment priorities, community perspectives are an important input into the decision-making process so that community-specific levels of service and corresponding asset/network performance expectations can be clearly defined. Communities may already be paying for additional resilience that should be considered and, where consumers or communities have indicated a willingness to pay, this should be supported by the reduction in risk.

4.3 Our expectation is that due to infrastructure providers' differing levels of asset management maturity, decision making frameworks will be applied differently in the short term, as maturity is being developed. We expect to see the more mature providers use the robust frameworks. We also expect to see providers applying good industry practice that is applicable to the industry they operate and using the guidelines that sector bodies produce and promote.

4.4 Not all tools will be suitable for all decisions, and the inclusion of a tool in this chapter does not mean it will necessarily be sufficient, on its own, to justify a material resilience investment, nor that it should be used for smaller or less complex decisions.

Decision-making frameworks

4.5 Table 4.1 sets out and describes various decision-making frameworks, with links to examples.

Table 4.1 Decision-making frameworks

Framework	Description	Links to examples
Cost-Benefit Analysis (also termed Social Cost Benefit Analysis)	Involves itemisation of individual costs and benefits of each option, and quantification of costs and benefits using a common metric of net present value.	Guide to Social Cost Benefit Analysis from the Treasury
Cost Effectiveness Analysis	Similar to cost-benefit analysis, but options are assessed based on the net present value of implementation costs.	Measuring cost-effectiveness in impact evaluation from the International Initiative for Impact Evaluation

Framework	Description	Links to examples
	This may be more useful where the objective or service outcome is relatively clear and the core question is which option delivers the outcome most efficiently.	
Real Options Analysis	An extensional method of quantifying benefits/costs that allows consideration of investment options that might adapt over time and seeks to put a value on the potential benefits of keeping options open, particularly where uncertainty is high and future conditions may materially change the preferred pathway.	Simplifying real options analysis for climate change adaptation from the Deep South Challenge
Multi-Criteria Analysis (MCA)	Comparing options by reference to an explicit set of objectives that have been identified, and for which it has been established measurable criteria to assess the extent to which objectives have been achieved. This can be useful for structuring trade-offs but should be applied carefully and transparently where it is being used to support more material expenditure decisions.	Guide to multi-criteria analysis from Infrastructure Australia Multi-criteria analysis: a manual from Communities and Local Government UK
Participatory Value Evaluation	Uses survey methods to estimate the value of alternative public investment options and may be useful where community preferences and trade-offs are an important part of the assessment.	The Economics of Participatory Value Evaluation from Thijs Dekker et al. Participatory value evaluation for the evaluation of flood protection schemes from Niek Mouter et al.
Robust Decision Making (RDM)	Options are selected on the basis that these perform well when compared to alternatives across a wide range of different assumptions and plausible futures. Metrics for evaluating robustness include satisfaction and regret. This may be particularly helpful where there is deep uncertainty and a single forecast or central case is unlikely to be sufficient.	A General, Analytic Method for Generating Robust Strategies and Narrative Scenarios from Management Science

Framework	Description	Links to examples
Dynamic Adaptive Policy Pathways (DAPP)	Maps out multiple potential pathways to achieve objectives. Involves designing series of actions that can be revised as conditions change and identifying tipping points that signal a need to reassess or shift to an alternative pathway. Applied mainly for long-lived, climate-sensitive infrastructure where future conditions are unpredictable. May be especially relevant for water and other sectors facing long asset lives and uncertain hazard trajectories.	Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world from Haasnoot et al. Dynamic Adaptive Policy Pathways example from Auckland Council.

Evaluation tools

4.6 In addition to the decision-making frameworks set out in Table 4.1, an infrastructure provider may want to also undertake more in-depth analysis using evaluation tools. Table 4.2 sets out an outline of the evaluation tools/techniques that could be used by infrastructure providers (e.g., CBA, MCA, etc) to support evaluation of component item level costs/benefits, criteria, etc.

4.7 It is important to note that these tools/techniques may also be used in isolation as an evidence base for decision-making, e.g., input-output analysis, CGE and MERIT for economic impacts to analyse the impacts on business and household consumers. Providers should, however, be clear about what question a tool is being used to answer, and why that tool is appropriate to the scale and purpose of the decision.

Table 4.2 Evaluation tools

Tool	Description	Links to examples
Input-Output Analysis	Assist in assessing higher-order impacts by capturing economic interdependencies within a regional or national economy. Tends to focus on inter-industry supply chains. Suitable for analysis of short-term economic implications of disruptions to household/business consumers. Not suitable for understanding price dynamics. Easy to use.	Economic impact of electricity supply interruptions in South Africa from Kingsley et al.

Tool	Description	Links to examples
Computable General Equilibrium Models (CGE)	Assist in assessing higher-order impacts by simulating the supply and demand for commodities and factors of production (labour and capital) as well as price changes and the flow of income through an economic system. There are several variants of CGE models (e.g. static, recursive dynamic, perfect foresight, etc), each of which has advantages and disadvantages. Selection of the appropriate variant depends on the application context and what questions of the model are being asked. Specialist skills required to apply.	Modelling Regional Economic Resilience to Disasters: A Computable General Equilibrium Analysis of Water Service Disruptions from Rose and Liao Economic consequence analysis of electric power infrastructure disruptions: General equilibrium approaches from Wing and Rose
MERIT (Modelling the Economics of Resilient Infrastructure Tool)	A New Zealand-specific set of tools that assists in understanding higher-order impacts of infrastructure disruptions. MERIT's core system dynamics-based economic model is like that of a fully dynamic CGE model; however, it uniquely can trace out-of-equilibrium dynamic impacts through time to consumers of multi-hazard (coincident and cascading) events. MERIT also contains several modules to assist in quantifying initial direct impacts for industries, utilities and consumers. Specialist skills required to apply.	Protecting Wellington's Economy Through Accelerated Infrastructure Investment Programme Business Case from Wellington Lifelines Accounting for economy-wide effects, risk aversion, and inequality aversion in the cost-benefit analyses of extreme events from Grimson et al. Economics of Fuel Supply Disruptions and Mitigations from MBIE

Tool	Description	Links to examples
Household-level modelling	Could operate as an extended version of another form of modelling (e.g. an advanced CGE/MERIT model), or a post-processing microsimulation model. The aim is to estimate economic impacts (e.g. changes in income) at the individual household or consumer level. This assists in understanding the distribution of impacts and in valuing impacts in 'utility' terms. Requires specialist skills to apply.	Accounting for economy-wide effects, risk aversion, and inequality aversion in the cost-benefit analyses of extreme events from Grimson et al.
Risk/Catastrophe models	Assist in deciphering the spatial complexity of risk by bringing together spatial layers of hazards and exposure with asset/process-specific vulnerability models. Accessible and relatively simple to apply, but typically only covers human and asset losses (i.e., not disruption losses); recovery costs may be included.	RiskScape Resilience Explorer
Agent based models	Captures the dynamic interaction of many agents, typically across space and through time, and is used for modelling many different contexts. Helps to decipher system complexity by identifying the emergence of patterns and trends in behaviour that result from the collective actions of agents. Requires considerable specialist skills and time to create; for the most part, only applied in large (multi-million dollar) research projects.	Agent-based modelling of interdependent critical infrastructures from Casalicchio et al. Agent-Based Societal Impact Modelling for Infrastructure Disruption and Countermeasures Analyses from Yang et al.
Integrated assessment methods	Typically involve creating critical feedback between existing disciplinary models (e.g. engineering, planning, economics), thus broadening the boundaries and system relationships under investigation.	Simulation of post-volcanic eruption time variant land use and economic impacts in the Auckland region of New Zealand from Cardwell et al.

Tool	Description	Links to examples
Stated preference methods	Utilise surveys or experiments to elicit what would hypothetically be paid for values, including values not traded in markets. Includes contingent valuation and choice modelling.	Value of Lost Load Study from Transpower
Revealed preference methods	Methods that estimate the value of a non-market good or service based on observed behaviour toward some closely connected marketed good or service. Includes defensive expenditure, travel costs method, and hedonic pricing.	Valuing the Reliability of the Electrical Power Infrastructure: A Two-stage Hedonic Approach from Maliszewski et al.
Cost-based valuation methods	The methods assume that some set of observed market costs can be used as a proxy for a benefit/cost. For example, expenditure on health care and lost wages as a proxy measure for the costs of waterborne diseases.	The Economic Costs of the Havelock North August 2016 Waterborne Disease Outbreak from Moore et al.

Chapter 5 Additional Information

Purpose of this chapter

5.1 This chapter provides links and resources for additional information on resilience and engagement. This information can be used to assist in applying this guidance document to the decision-making process, or to explore a wider or more thorough resilience assessment and implementation.

Examples of existing resilience work across New Zealand

5.2 The Electricity Engineers Authority (EEA) Asset Management Group has developed Resilience Guidelines for the electricity supply industry.

5.3 The Department of the Prime Minister and Cabinet's work on Critical Infrastructure Resilience.

5.4 The Infrastructure Commission's Infrastructure Priorities Assessment Framework.

5.5 Infrastructure Commission – Invest or Insure? Research of preparing infrastructure for natural hazards.

International examples of resilience assessment and standards

5.6 Infrastructure Australia – Resilience Principles

5.7 The UK Government Resilience Framework

5.8 Canada – National Strategy for Critical Infrastructure

More information on the three other areas impacting resilience outcomes

5.9 ResOrgs – What is organisational resilience?

5.10 ResOrgs – New Zealand Resilience Index toolkit

5.11 Downer and NZIER – The New Zealand Infrastructure Resilience Index

5.12 National Emergency Management Agency (NEMA) – Coordinated Incident Management System (CIMS) third edition

Community and Iwi engagement

5.13 Department of the Prime Minister and Cabinet (DPMC) – Community Engagement

5.14 The Policy Project – Good Practice Guide for Community Engagement (April 2023)

5.15 Te Puni Kōkiri – Crown engagement with Māori (framework and guidelines)

Chapter 6 Providing feedback on this draft guidance

We are seeking your feedback

6.1 This draft guidance has been published for stakeholder feedback. We would like to know which parts of the guidance document are useful, and what could be changed to ensure it is as helpful as possible. We would also like to know if there is anything you think is missing, or if there are unintended consequences or conflicts that we have not identified or addressed.

6.2 We welcome free-form feedback, and for purposes of collating views across stakeholders would appreciate responses to the consultation questions below.

6.3 We also welcome feedback on the 'Infrastructure Resilience - Key principles for regulating the performance of utilities' prepared for the Commission by resilience experts ResOrgs and published alongside this draft guidance document.[2]

Instructions for how to submit

6.4 Please send your feedback to the Commission by 5:00pm Friday 31 July 2026. If you would like an extension to the submission timeframe, please contact us to request this as soon as possible, with the reason for the extension.

6.5 If you would like to make a written submission, please send your submission to:

infrastructure.regulation@comcom.govt.nz

c/o Elloise Kidd, Senior Analyst, Electricity Distribution

6.6 Please include 'Submission: Draft Resilience Guidance Feedback' in the subject line of your email.

Format for submissions

6.7 We prefer submissions in both a format suitable for word processing (such as Microsoft Word document) as well as a 'locked' format (such as a PDF) for publication on our website.

[2] ResOrgs, 'Infrastructure Resilience - Key principles for regulating the performance of utilities. Prepared for Commerce Commission, August 2025.

Confidential submissions

6.8 While we discourage requests for non-disclosure of submissions so that all information can be tested in an open and transparent manner, there may be cases in which submitters wish to provide information in confidence.[3] We offer the following guidance:

6.8.1 if it is necessary to include confidential material in a submission, the information should be clearly marked, with reasons why it is confidential;

6.8.2 where commercial sensitivity is asserted, submitters must explain why publication of the information would be likely to unreasonably prejudice their commercial position or that of another person who is the subject of the information;

6.8.3 both confidential and public versions of the submission are required to be provided;

6.8.4 the responsibility for ensuring that confidential information is not included in a public version of a submission rests entirely with the party making the submission; and

6.8.5 we request that you provide multiple versions of your submission if it contains confidential information or if you wish for the published electronic copies to be 'locked'. This is because we intend to publish all submissions on our website. Where relevant, please provide both an 'unlocked' electronic copy of your submission, and a clearly labelled 'public version'.

Consultation questions

Making our guidance clear and effective

1. Is the draft guidance clear about its purpose and practical status, including the level of analysis and rigour the Commission expects for more material resilience expenditure proposals?
2. Is it clear how the draft guidance should be applied proportionately across sectors with different levels of maturity?
3. Are there implementation barriers, overlaps, or accountability issues in the wider resilience and regulatory landscape that may affect how this guidance is applied in practice?

[3] Parties can also request that we make orders under s 100 of the Act in respect of information that should not be made public. Any request for an s 100 order must be made when the relevant information is supplied to us and must identify the reasons why the relevant information should not be made public. We will provide further information on s 100 orders if requested by parties. A key benefit of such orders is to enable confidential information to be shared with specified parties on a restricted basis for the purpose of making submissions. Any s 100 order will apply for a limited time only as specified in the order. Once an order expires, we will follow our usual process in applying the Official Information Act 1982 in respect of any request for information provided to us in relation to this matter.

4. What areas should the Commission prioritise in further work (for example, business case guidance, resilience measures, maturity assessment, interdependency information, or reporting)?

Completeness and usefulness

5. Which aspects of the draft guidance are most helpful for informing your investment decision making, and why?
6. Which parts of the draft guidance are unclear, unnecessary, or could be improved? Please explain.
7. Are any principles missing? Are there areas of overlap where the principles could be simplified or streamlined?
8. Are there any missing frameworks or evaluation tools that should be included or referenced?

Your current approach and experience

9. To what extent do you already apply these principles in your resilience-related decision-making processes? If not, what currently guides your resilience-related investment decisions?
10. Do you have practical examples of applying these principles - in a specific sector, or cross-sector - that could be shared to support other users of the guidance?

Community, Māori and place-based considerations

11. How should the framework recognise and reflect iwi, hapū, and Māori perspectives, including capability, resources, and relationships that support resilience, particularly in smaller or more isolated communities?
12. Which cross-sector vulnerabilities and interdependencies should the framework place the greatest emphasis on, and expect infrastructure providers and the Commission to pay closest attention to?