

# Climate Change Resilience for Buildings & Homes

Guidance for Climate Change Risk Assessment &  
Adaptation Planning



**Acknowledgements:**

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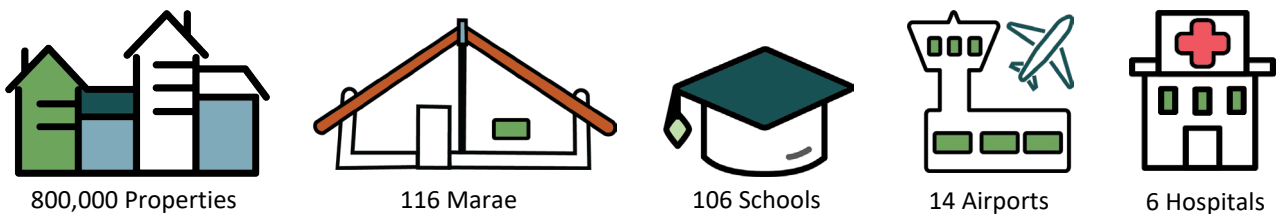
## 1.0 Introduction

The impacts of climate change are here, in Aotearoa New Zealand, now. Climate change is already impacting New Zealand’s built environment, including commercial buildings and homes, and will continue to do so for the foreseeable future (IPCC, 2021). As our climate continues to change, we face a future where extreme climate events are expected to become more frequent and intense.

Climate change risks are experienced in the built environment when buildings, communities, and supporting infrastructure is exposed and vulnerable to a climate change hazard, such as flooding.

As highlighted by recent extreme weather events, New Zealand buildings and homes are increasingly at risk from a range of climate change hazards such as sea-level rise and extreme rainfall events. With the effects of climate change ‘baked-in’ to our environment for the next few decades, New Zealand’s buildings and homes must plan to adapt to the climate change risks they will face.

The following New Zealand buildings and homes are exposed to coastal flooding and isolation from just 0.2m of sea-level rise, expected in the next few decades<sup>1</sup>



To support users to understand the climate change risks to a building or home and identify actions to increase their resilience, the New Zealand Green Building Council (NZGBC) has led the development of this guidance for climate change risk assessment and adaptation planning.

This guidance sets out a risk assessment and adaptation planning framework for buildings and homes in New Zealand, consistent with national and local climate change risk assessment frameworks.

### 1.1 Purpose of this guidance

The purpose of this guidance is to provide the framework and tools to conduct a robust, evidence-based climate change risk assessment for a building or home and prepare a climate change adaptation plan.

Included in this document are:

- Climate change risk assessment guidance and example templates
- Climate change adaptation plan guidance and example templates
- Climate change data resources

This guidance aims to promote consistency and transparency in climate change risk assessments and adaptation planning for New Zealand buildings and homes, ensuring users are able to make informed decisions to manage risks and improve resilience.

### 1.2 Using this guidance

Who should use this guidance?

This guidance is aimed at individuals and organisations across New Zealand seeking to improve the resilience of their building or home to the effects of climate change. This includes building and homeowners, developers,

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<sup>1</sup> Urban Intelligence, 2024

or building and property managers who require guidance to conduct a climate change risk assessment and prepare an adaptation plan.

For users pursuing NZGBC Green Star or Homestar climate resilience credits, additional technical guidance is provided in Appendix C for Green Star and Appendix D for Homestar.

### When should this guidance be used?

Climate change risk assessment and adaptation planning for buildings and homes should be considered as early as possible in a project lifecycle. Ideally considering potential climate change risks during site selection and concept design, and revisiting at key stages such as detailed design, construction, and any major refurbishments.

Beginning the climate change risk assessment process as early as possible delivers significant benefits in terms of cost, performance, and long-term resilience. Early consideration allows climate change risks to be addressed through strategic decisions, such as site layout, floor levels, orientation, materials, and design, rather than relying on costly retrofits or protective measures later in the building's life.

When considering climate change risks and adaptation planning early in a project's lifecycle, an iterative approach can make best use of the available information and opportunities at each stage of the project. For example, establishing the scope and conducting a high-level risk identification process during site selection and concept design can help inform early strategic decisions for adaptation. Risks can then be assessed in more detail throughout the design and construction stages to identify if further adaptation action is needed immediately or should be planned for during the building's lifetime.

### Support and endorsement

"ASAP | RUA welcomes this guidance as a valuable and timely contribution to climate adaptation practice in Aotearoa New Zealand.

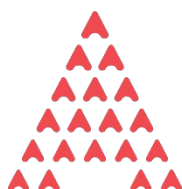
This work represents an important step toward more consistent and practical approaches to climate risk assessment and adaptation planning across the built environment. It provides a clear, evidence-based framework to support practitioners, project teams, and asset owners to better understand and respond to climate risks.

We see this as a strong foundation for building capability and embedding climate adaptation into decision-making over time, supporting more resilient outcomes for buildings, communities, and infrastructure."

#### **Sarah Bogle**

Co-convenor, ASAP | RUA

Aotearoa Society of Adaptation Professionals | Rōpū Urutaunga Aotearoa



**ASAP | RUA**

Aotearoa Society of Adaptation Professionals  
Rōpū Urutaunga Aotearoa

### 1.3 The risk assessment and adaptation planning process

This guidance sets out a four-stage process to carry out a climate change risk assessment and adaptation plan for a building or home shown in Figure 1. The guidance is consistent with Arotakenga Huringa Āhuarangi: A Framework for the National Climate Change Risk Assessment for Aotearoa New Zealand and He kupu ārahi mō te aromatawai tūraru huringa āhuarangi ā-rohe A guide to local climate change risk assessments.

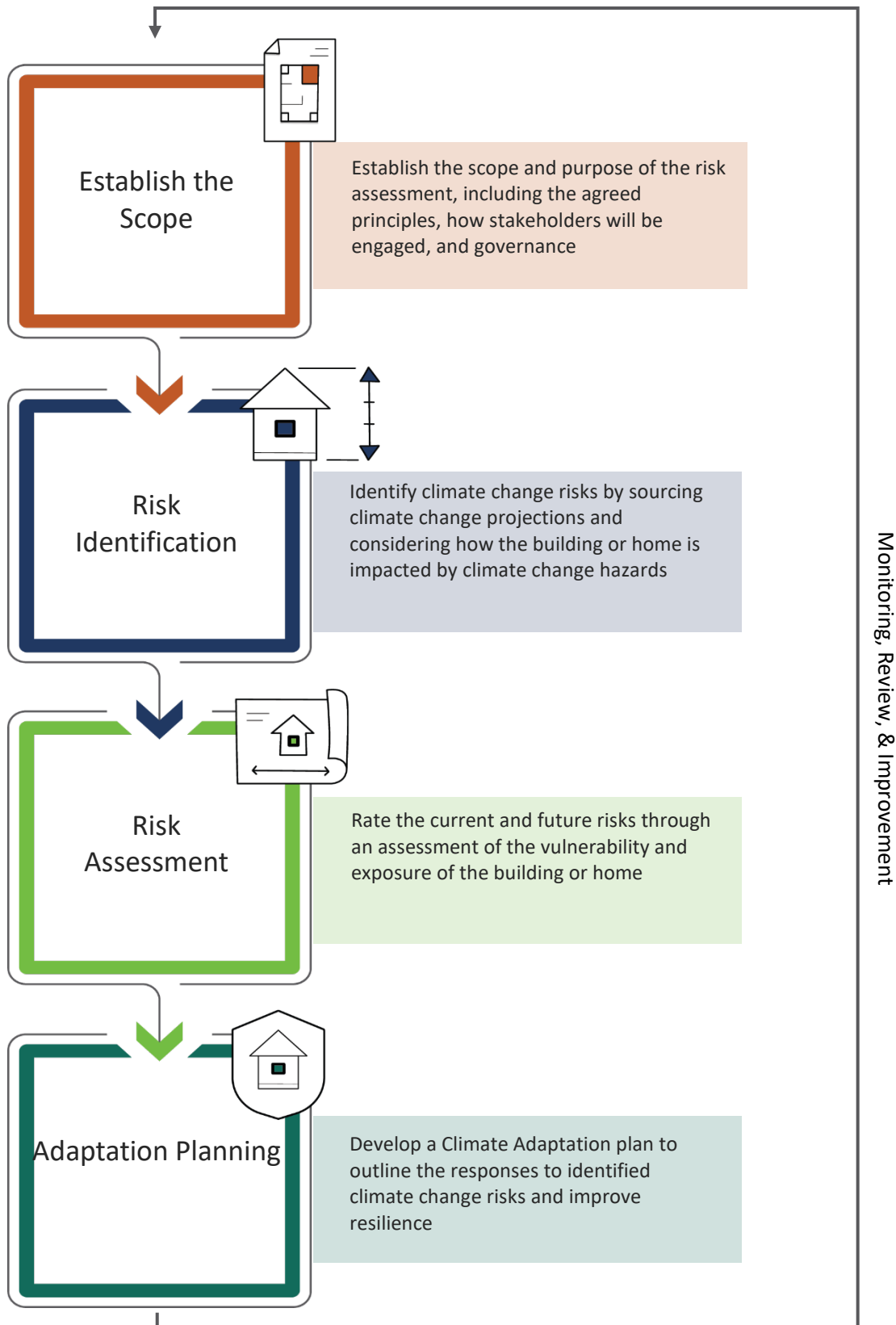


Figure 1: The climate change risk assessment and adaptation planning process

# Checklist for risk assessment and adaptation planning

## Establish the Scope

### Key actions



- Define the scope of the climate change risk assessment and adaptation planning process.
- Agree the climate change scenarios that will be considered in the risk assessment.

## Risk Identification

### Key actions

- Source climate change projections for project location
- Identify the climate change hazards present in the project location
- Screen climate change hazards against the building and home elements at risk
- Produce indicative climate change risk statements

### Guidance Tools

-  Risk Identification Matrix
-  Risk Assessment Register

## Risk Assessment

### Key actions

- Assess and rate exposure and vulnerability of identified elements at risk
- Assign a climate change risk rating
- Review existing risk controls and treatments

### Guidance Tools

-  Risk Assessment Register

## Adaptation Planning

### Key actions

- Identify adaptation options to address unacceptable climate change risks
- Plan and prioritise adaptation actions
- Monitor and review adaptation plan over time

### Guidance Tools

-  Adaptation Plan Template

# Risk Assessment & Adaptation Planning Stages



## 2.0 Establish the Scope

Establishing the scope and context of a climate change risk assessment and adaptation planning process is important to create a clear understanding on what is being assessed and how it will be done.

Key questions to consider in establishing the scope of a climate risk assessment include:

- Experience - have you, your organisation, or your client done a climate risk assessment before? If so, there is an opportunity to build on previous work and target focus areas for your next assessment.
- Scale - what is the size of your project your assessment will focus on? This can influence who needs to be involved in the process including stakeholders, the resources, and capacity to complete the process.
- Compliance - do you or your organisation have any specific regulatory obligations or compliance requirements that could be relevant? Compliance with these requirements will be an important consideration in your risk assessment process.
- Organisational Capabilities - If a commercial business, does your organisational structure have a dedicated risk management function or climate and sustainability team to support the process? If so, find out what support they can provide, what their involvement should be, and any risk management information that is pertinent to the scope of the risk assessment.
- Organisational Frameworks - If a commercial business, does your organisation have an enterprise risk management framework that any risk management actions will need to adhere to? Understanding these existing requirements will inform how to integrate climate risk into more regular work activities.
- Past Events - How have climate and previous weather events affected the project area? For buildings and homes, this history can be a valuable reference point for understanding the sites potential exposure to climate change hazards.
- Timeframes – What is the intended lifespan of the building or home being assessed? These timeframes are important for climate change risk assessment, as it ensures that risks relevant to the structure's lifetime are fully considered.
- Stakeholders – Who should be involved in the risk assessment and adaptation planning process? Stakeholder engagement is an opportunity to acquire knowledge, experience, evidence, and build a mutual understanding within and potentially beyond your organisation. Identifying individuals with the appropriate level of knowledge and confidence to engage in the process is important. Types of stakeholders that may be considered include:
  - Key functions within an organisation, such as procurement, finance, human resources, legal, facilities and/or asset management, risk management, and sustainability.
  - For risk governance, senior executives involved in the development, implementation, monitoring and/or evaluation of outcomes
  - Broader perspectives, including building end users, industry groups, local iwi and hapū, other agencies involved in the project design and delivery.

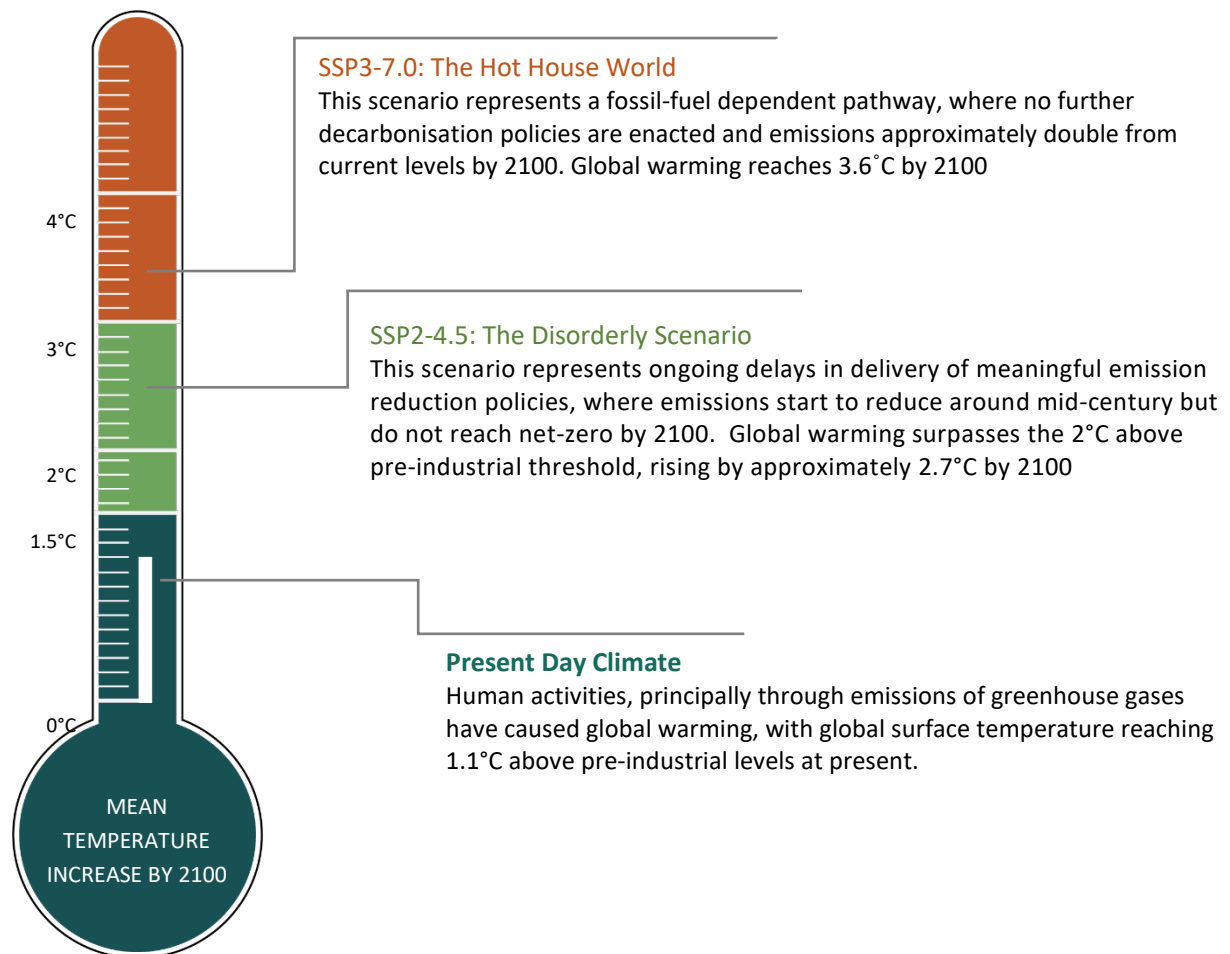
### 2.1 Understanding climate change projection scenarios

Establishing a clear understanding of how to interpret and use climate change projection scenarios is important for the delivery of a climate change risk assessment and adaptation planning process.

By exploring a range of plausible futures, climate change scenario analysis allows us to understand how this uncertain future may look, and to build resilience to the challenges that may come. Projections of how certain climate variables may change (e.g. sea-level or rainfall) are based on scenarios. Shared Socio-economic

Pathways (SSP) scenarios developed by the Intergovernmental Panel on Climate Change (IPCC), provide the most recent climate change projections available.<sup>2</sup>

SSP scenarios provide information of the plausible climate conditions New Zealand buildings and homes will experience in future decades. Scenarios are based on the future trajectories of population, economic growth, and greenhouse gas emissions. In New Zealand, two climate change scenarios are commonly used in a risk assessment process – a mid-range emissions scenario (SSP2-4.5) and a high-end emissions scenario (SSP3-7.0).



### Climate change scenarios: Understanding RCP's and SSP's

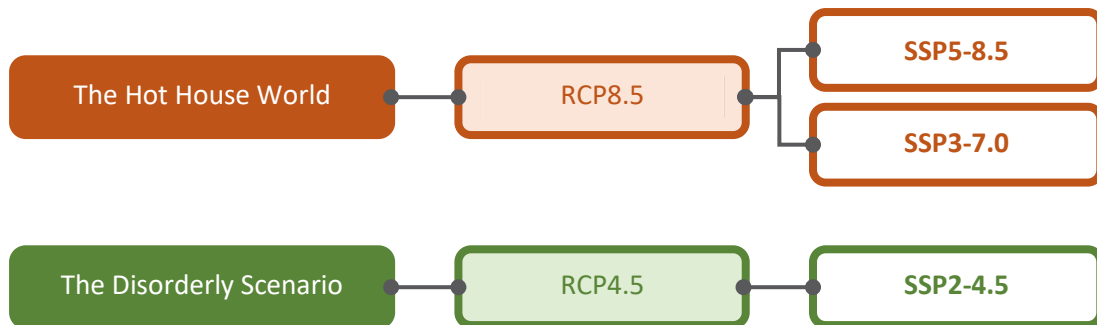
In August 2021, IPCC published its Working Group 1 contribution to the Sixth Assessment Report (IPCC, 2021). This report addresses “the most up-to-date physical understanding of the climate system and climate change, bringing together the latest advances in climate science, and combining multiple lines of evidence, observations, process understanding, and global and regional climate simulations.”

Unlike the IPCC Fifth Assessment Report which used Representative Concentration Pathways (RCPs), the Sixth Assessment Report relies on Shared Socioeconomic Pathways (SSPs) to model future climate change scenarios. In contrast to the previously used RCPs, the SSPs were designed such that the emission scenarios originate from a wide array of socioeconomic drivers. These include population growth, technological development and economic development.

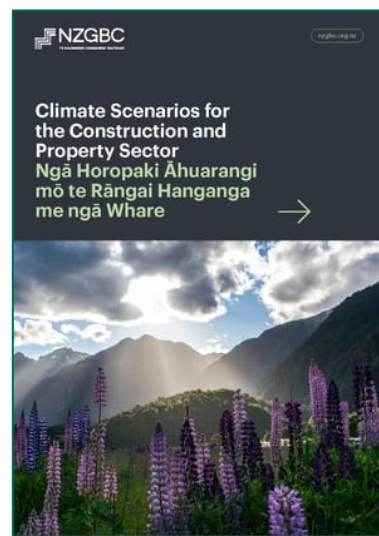
<sup>2</sup> The SSPs outlined in the IPCC Sixth Assessment Report (AR6) are intended to update the previously used Representative Concentration Pathways (RCPs), complementing the RCP scenarios with models of how socio-economic factors such as population, education, and urbanisation can influence emission reduction pathways

While some of the SSP scenarios and RCP scenarios reach the same amount of warming by 2100 (e.g. SSP2-4.5 and RCP4.5), the greenhouse gas concentration pathways taken to reach that radiative forcing are not necessarily the same between scenarios. For example, the SSPs feature a larger maximum concentration of carbon dioxide (CO<sub>2</sub>), with the CO<sub>2</sub> concentration in SSP5-8.5 approximately 200 parts per million (ppm) larger in 2100 compared to RCP8.5.

While not identical, the SSP3-7.0 or SSP5-8.5 may be used as a project's 'high-emission scenario' where available, as specified in the IPCC Sixth Assessment Report (IPCC, 2021). Section 3.0 provides further guidance on how to select the relevant climate change scenarios for a risk assessment.



For more information about climate change scenarios for the New Zealand Construction and Property sector, see the following report prepared for Te Kaunihera Hanganga Tautaiāo | New Zealand Green Building Council



## 2.2 Engaging others on risk and adaptation planning

Stakeholder engagement is important in supporting successful climate change adaptation actions for buildings and homes. When floods, fires, or unexpected hazards occur, it's not just emergency alerts and well-built infrastructure that protect lives and livelihoods – it's people.

Academic research and New Zealand's national guidance both suggest that climate change adaptation outcomes are improved for affected communities and stakeholders when they work together closely to understand the implications, co-develop adaptation plans, and support agreed actions for adaptation. Building and community stakeholders can hold practical information about climate change hazards and risks, which can add significant value to risk assessment and adaptation planning processes.


The need for engagement in a risk assessment and adaptation planning process, and the approach taken, will depend on the scale and complexity of the project. Larger, more complex projects typically benefit most from more structured engagement processes. Table 1 provides an example of the key stakeholders who may be engaged in a climate change risk assessment and adaptation plan. This is not an exhaustive list – engagement requirements should be informed by a project's unique context.

Table 1: Common key stakeholders that may be engaged in a building or home risk assessment and adaptation plan.

Internal	External
<ul style="list-style-type: none"> <li>• Occupants / Tenants</li> <li>• Health &amp; Safety Personnel</li> <li>• Structural &amp; Building Engineers</li> <li>• Finance &amp; Procurement Managers</li> <li>• Human Resources Personnel</li> <li>• Governance Bodies</li> </ul>	<ul style="list-style-type: none"> <li>• Contractors &amp; Service Providers</li> <li>• Insurance Providers</li> <li>• Local Emergency Services</li> <li>• Local Council</li> <li>• Neighbours</li> <li>• Iwi &amp; Hapū</li> </ul>

Any engagement process should follow accepted good practice, for example, the International Association of Public Participation (IAP2) process of design, methods and evaluation.<sup>3</sup> The IAP2 Spectrum of Public Participation is designed to assist users with the selection of the level of engagement that may be used during a risk assessment and adaptation planning process.

Table 2: Spectrum of Public Participation, adapted from IAP2.

Increasing impact on the decision 					
	Inform	Consult	Involve	Collaborate	Empower
Goal	Provide balanced and objective information to assist stakeholders in understanding the problem, alternatives, opportunities and/or solutions.	Obtain stakeholder feedback on analysis, alternatives and/or decisions.	Work directly with the stakeholder throughout the process to ensure that concerns and aspirations are consistently understood and considered.	Partner with the stakeholder in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	Place final decision making in the hands of the stakeholder.

<sup>3</sup> International Association for Public Participation (2023)

## 3.0 Identifying Climate Change Risks

Stage: Risk Identification

Objective	Actions
Identify the ways in which a building or home could be affected by climate change	Review climate change projections and consider how a building or home may be impacted by climate-related hazards
Outcomes	A preliminary list of risk statements

Generally, for buildings and homes, a risk relates to the potential for damage or loss of an element relating to the structure or function of the building or home. E.g. damage to exterior walls and cladding from sea-level rise and coastal inundation.

Risk identification is a first-pass assessment that seeks to identify a building or home’s likely climate change risks. In this stage, the user will identify the local climate hazards for their project area and assess these against the potential ‘elements at risk’ in a building or home.

Risk identification can be conducted through a combination of quantitative and qualitative approaches, including review of climate change hazard projections, subject matter expert input, and stakeholder engagement. All risks identified should be considered, even if they prove later to be trivial or duplicates of other risks. The risk assessment stage will screen out the trivial issues and duplicate risks can be drawn together later in the risk register if necessary.



Figure 2: Work process for risk identification stage

### 3.1 Identify climate hazards

To identify the relevant climate change projections and hazards a building or home may be exposed to, users will need to source climate change projection information. Information can be gathered from a variety of publicly available sources, including:

- New Zealand national climate change projection map and database.
- Regional and Territorial Local Authority climate change assessments and resources.
- New Zealand databases for coastal inundation, erosion, and flood hazards.

Appendix A provides an inventory of publicly available climate change information sources that can be used to inform the identification of climate hazards.

For some hazards, quantitative data may be unavailable for the location of the building or home (e.g. wildfire). In these instances, gaps in published literature and relevant data should be acknowledged. Subject matter expert assessment of the current and future state of these hazards can be used to help inform the risk identification and risk analysis components of the methodology.

Selecting climate change scenarios and timeframes for identifying climate hazards

Climate change information can be sourced from a range of different climate change scenarios and future timeframes, modelled on the future trajectories of population, economic growth, and greenhouse gas emissions.

### Climate change scenarios

Ideally, users should seek to use two climate change scenarios to inform a detailed risk assessment process, commonly using a mid-range emissions scenario (SSP2-4.5), and high-end emissions scenario (SSP3-7.0).

On non-complex projects and where budget and time constraints may limit the scope of a risk assessment to just one climate change scenario, SSP3-7.0 is recommended to be used. As a high-end emissions scenario, using SSP3-7.0 provides a precautionary approach to risk assessment and helps to identify the most significant risks if warming continues unabated.

### Future timeframes

Users should source climate change information for future timeframes which are relevant to the anticipated lifespan of the building or home.

Three main timeframes are recommended to inform a risk assessment process for buildings and homes:

- Present day - The impacts already occurring from climate change are a starting point for considering the urgency of the risks you identify.
- Mid-Century (around 2050) - This covers the lifespan of many services associated with buildings and homes, such as stormwater systems and HVAC, and the planning timeframe for local government infrastructure strategies and asset management plans. It also aligns with the longer terms granted for resource consents.
- End of Century (by 2100) - Typically used as the juncture for detailed climate change projections. A limitation of this timescale is that some decisions require at least 100-year timeframes.

Note, climate change information available in New Zealand can be modelled based on two historical baselines (1986-2005 and 1995-2014).

- The 1986-2005 baseline was used for the previous projections for New Zealand (i.e. the RCP scenarios).
- The 1995-2014 baseline is consistent with the IPCC Sixth Assessment Report

The data for these baselines represent the average climate conditions in the recent past. Users should ensure when sourcing climate change information, a consistent historical baseline has been applied.

### Climate change hazards

To identify climate hazards, users should consider a range of acute and chronic hazards that may arise from climate change.

A broad range of example hazards is provided in Table 3 along with the primary climate change projection variables that can be considered when analysing a hazard.

Table 3: Example climate change hazards list, adapted from Ministry for the Environment, 2019.

Hazard	Climate change variables to be considered
Higher mean temperatures	<ul style="list-style-type: none"> <li>○ Higher day and night temperatures</li> <li>○ Higher mean water temperatures</li> </ul>
More frequent and persistent heatwaves	<ul style="list-style-type: none"> <li>○ Higher day and night temperatures</li> <li>○ Increase in number of days above 25°C</li> </ul>

More and longer dry spells and drought	<ul style="list-style-type: none"> <li>○ Low seasonal rainfall</li> <li>○ Change in seasonal wind patterns</li> <li>○ Interannual variability</li> </ul>
Changes in climate seasonality	<ul style="list-style-type: none"> <li>○ Fewer frosts or cold days</li> <li>○ Higher day and night temperatures</li> <li>○ Changes in seasonal rainfall</li> </ul>
Increasing fire weather conditions	<ul style="list-style-type: none"> <li>○ Low seasonal rainfall</li> <li>○ Change in seasonal wind patterns</li> <li>○ Increase in maximum daily temperatures above 25°C</li> <li>○ Humidity changes</li> </ul>
Changes in mean and extreme winds	<ul style="list-style-type: none"> <li>○ Changes in mean wind speed</li> <li>○ Changes in extreme wind speed</li> </ul>
Change in mean annual rainfall	<ul style="list-style-type: none"> <li>○ Higher or lower mean annual rainfall</li> <li>○ Changes in seasonal winds</li> </ul>
More frequent and intense extreme rainfall events	<ul style="list-style-type: none"> <li>○ Changes in extremes rainfall events: intensity and persistence of rainfall</li> </ul>
Changes in river and pluvial flooding	<ul style="list-style-type: none"> <li>○ Changes in extremes: intensity and persistence of rainfall</li> <li>○ Interannual variability</li> <li>○ Increased storminess and wind</li> <li>○ Relative sea-level rise (including land movement)</li> <li>○ Rising groundwater from sea-level rise</li> </ul>
More frequent and severe coastal and estuarine flooding	<ul style="list-style-type: none"> <li>○ Relative sea-level rise (including land movement)</li> <li>○ Permanent increase in spring high-tide inundation</li> <li>○ Rising groundwater from sea-level rise</li> <li>○ Changes in intensity and persistence of rainfall</li> </ul>
Sea-level rise and salinity stresses	<ul style="list-style-type: none"> <li>○ Relative sea-level rise (including land movement)</li> <li>○ Permanent and episodic saline intrusion</li> <li>○ Rising groundwater from sea-level rise</li> <li>○ Permanent increase in spring high-tide inundation</li> </ul>
Increasing coastal erosion	<ul style="list-style-type: none"> <li>○ Relative sea-level rise (including land movement)</li> <li>○ Changes in extreme rainfall: intensity and persistence</li> <li>○ Changes in sedimentation from catchment run off</li> <li>○ Increased storminess and extreme wind</li> </ul>
Increasing landslides and soil erosion	<ul style="list-style-type: none"> <li>○ Changes in extreme rainfall: intensity and persistence</li> <li>○ Changes in rainfall seasonality</li> <li>○ More and longer dry spells and droughts</li> </ul>

### 3.2 First pass assessment of risks

When a user has sourced information of the climate change hazards relevant to the building or home, the next step is to screen these hazards against the potential ‘elements at risk’ (e.g. structure, function, occupants, etc). The aim of this step is to make a list of the potential risks to the building or home, drawing on knowledge from subject matter experts, project partners, and stakeholders. This can be achieved through a combination of online surveys, stakeholder workshops, and desktop research.

During the establishment stage, a preliminary stocktake of relevant indicators for potential ‘elements at risk’ for the building or home can be gathered to help inform the first pass assessment of risks. To provide an overview of the potential risk profile for the building or home, risks can be listed in a matrix format.

An example risk screening matrix is provided in the ‘Climate Change Risk & Adaptation Workbook’, in Appendix B.

### 3.3 Producing indicative climate change risk statements

Following the first pass assessment of the risk, where the climate change hazards have been screened against the potential ‘elements at risk’, users should seek to develop indicative risk statements for each element at risk identified.

At a high level, an indicative risk statement should describe how a hazard(s) may cause an impact on the structure or functionality of a building or home. Risks can be described simply using the logic described in Table 4 below.

Once developed, risk statements should be entered into the risk register. A template risk register is provided in the ‘Climate Change Risk & Adaptation Workbook’, in Appendix B.

Table 4: Logic for developing indicative climate change risk statements.

Indicative Risk Statement Logic Inputs	
Information	Example
Climate change hazard:	Dry spells and drought
Direction of change:	Increasing in frequency and duration
Element exposed to the hazard:	Water supply and use
Risk Statement	
Risk to water supply and use from more frequent and longer dry spells and drought events	

## 4.0 Assessing Climate Change Risks

Stage: Risk Assessment

Objective	Actions
Assess the current and future magnitude of the identified climate change risks	Assess the vulnerability of elements at risk and the current and future exposure to the identified climate change hazards across relevant timeframes
Outcomes	A database of climate change risks with assigned ratings

The risk assessment stage assigns risk ratings to the identified climate change risks, taking into account each of the climate change scenarios and timeframes being considered in the risk assessment.

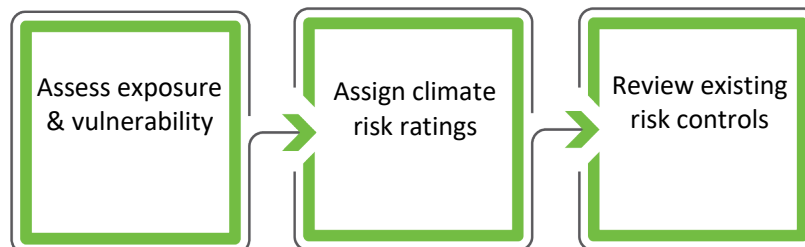


Figure 3: Work process for the risk assessment stage

Climate change risks can be rated through an assessment of the exposure and vulnerability of a hazard occurring. Aligning with national and local climate change risk assessment frameworks used in New Zealand and drawing from the IPCC conceptual risk framework, this approach demonstrates that risks arise from the interactions shown in Figure 4:



### Hazard

The potential occurrence a hazard, triggered by a climate change related event or trend

### Vulnerability

The sensitivity or susceptibility of an element relating to the structure or function of a building or home to be adversely affected – or its capacity to cope and adapt

### Exposure

The presence of an element relating to the structure or function of a building or home in places and settings that could be adversely affected

Figure 4: Climate change risk as the interaction between climate change hazards, vulnerability, and exposure.

For buildings and homes, a risk assessment should acknowledge that many climate change and natural hazard risks are accounted for within the design process or actively managed through organisational or institutional standards and policies. In many instances, the existing risk controls and treatments will effectively address climate change risks to a building or home resulting in a reduced residual risk for the user to manage. However, in cases where the residual risk remains unacceptable, further adaptation action must be identified.

## 4.1 Assessing exposure & vulnerability

Climate change risks are assessed through a qualitative and/or quantitative ranking of exposure and vulnerability.

A common challenge with risk assessments is that climate change risks are complex and often lack robust evidence as to how the physical impacts of climate change may impact and interact with the elements at risk. Accordingly, while the climate change scenarios provide a quantitative evidence base for the projected magnitude of change, risk assessments are typically a qualitative exercise, drawing on subject matter expertise and stakeholder input.

The ‘Climate Change Risk & Adaptation Workbook’ in Appendix B, provides users with example criteria for assessing exposure and vulnerability.

### Exposure

Exposure refers to the presence of an element relating to the structure or function of a building or home in places and settings that could be adversely affected by a climate change hazard.

When assessing exposure, it is important to consider the spatial location and extent (quantity) of an element at risk to the hazard. Assessing exposure can often be uncertain and in many cases, it is unlikely that there will be enough data for a detailed quantitative rating – in these cases, a qualitative rating can be assigned, taking account of the how the intensity or frequency of a hazard is projected to change.

Table 5 provides an example scale for rating exposure from Low to Extreme that can be used for buildings and homes, consistent with New Zealand national and local climate change risk assessment frameworks.

Table 5: Example exposure rating scale

Exposure rating	Qualitative definition
Extreme	Significant and widespread exposure of elements to the hazard. E.g. A building or home is located where climate change hazards are expected to directly affect the site with high frequency and/or intensity.
High	High exposure of elements to the hazard. E.g. A building or home is located where climate change hazards are likely to affect the site, but with less frequency or intensity than extreme exposures, or where impacts occur periodically rather than continuously.
Moderate	Moderate exposure of elements to the hazard. E.g. A building or home is located where climate change hazards are likely to occur infrequently or be impacted indirectly. Impacts generally occur during extreme or acute climate events or under longer-term climate change scenarios.
Low	Isolated elements are exposed to the hazard. E.g. A building or home is located where climate change hazards are unlikely to directly affect the site.

### Vulnerability

Vulnerability refers to the sensitivity or susceptibility of an element relating to the structure or function of a building or home to be adversely affected – or its capacity to cope and adapt. When assessing vulnerability, it is important to consider both the sensitivity of the element at risk and its adaptive capacity to a particular climate change hazard occurring:

- Sensitivity refers to the degree to which an element at risk is affected by a climate change hazard, and the impact or consequence of the hazard occurring. In buildings and homes, sensitivity relates to how susceptible the element is to harm when exposed to a hazard and how critical the harm is to the structure or function of the building or home.
- Adaptive capacity refers to the ability of elements, systems, structures, and institutions to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. In buildings and homes, adaptive capacity relates to how an element at risk may cope, adapt autonomously, or be adapted when exposed to a hazard.

Like assessing exposure, it is unlikely that there will be enough data for a detailed quantitative rating, so vulnerability ratings (of both sensitivity and adaptive capacity) are frequently assigned through a qualitative assessment. However, where available quantitative data such as fragility functions, maximum load/capacities, or operating ranges may be used to inform the rating. For assigning sensitivity and adaptive capacity ratings to determine an overall vulnerability rating, a four-point scale can be used as shown in Table 6; rating sensitivity from Low to Extreme; and rating adaptive capacity from Very Low to High.

Table 6: Example vulnerability matrix (combining sensitivity rating and adaptive capacity rating) and rating scale

		Sensitivity			
		Low	Moderate	High	Very High
Adaptive Capacity	Very Low	Moderate	High	Extreme	Extreme
	Low	Low	Moderate	High	Extreme
	Moderate	Low	Moderate	Moderate	High
	High	Low	Low	Low	Moderate
Vulnerability rating					
Extreme		Extremely likely to be adversely affected, because the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.			
High		Highly likely to be adversely affected, because the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.			
Moderate		Moderately likely to be adversely affected, because the element is moderately sensitive to a given hazard and has a low or moderate capacity to adapt.			
Low		Low likelihood of being adversely affected, because the element has low sensitivity to a given hazard and a high capacity to adapt.			

As demonstrated in Table 6, a higher adaptive capacity of an element at risk will reduce the overall vulnerability rating. However, rating an element's adaptive capacity should take a conservative approach for buildings and homes, particularly where repair or replacement of an element requires significant investment.

For rating vulnerability, any assumptions and/or quantitative data that have been used to inform either the adaptive capacity or sensitivity ratings should be recorded. This is important for providing transparency in risk assessment outcomes, particularly where high adaptive capacity is deemed to reduce the overall vulnerability of elements at risk.

## 4.2 Assigning climate change risk ratings

Ratings of exposure and vulnerability of elements at risks can be combined to produce a climate change risk rating for each climate change scenario and timeframe considered in a risk assessment. Should a user select multiple climate change scenarios and timeframes to inform a risk assessment, this will show how climate change risks may change over time.

Similar to exposure and vulnerability, where possible, the risk matrix used should align with the building or homeowners risk appetite or organisational risk management framework. Table 7 provides an example of a common risk rating matrix that considers the interactions between risk exposure and vulnerability, consistent with New Zealand national and local climate change risk assessment frameworks.

Table 7: Example risk matrix (combining exposure rating and vulnerability rating)

		Exposure			
		Low	Moderate	High	Very High
Vulnerability	Extreme	Moderate	High	Extreme	Extreme
	High	Low	Moderate	High	Extreme
	Moderate	Low	Moderate	Moderate	High
	Low	Low	Low	Moderate	High

The interpretation of these climate change risk rating levels is generally as follows:

- **Extreme** risks demand urgent attention at the most senior level and cannot be simply accepted as a part of routine operations without executive sanction.
- **High** risks are the most severe that can be accepted as a part of routine operations without executive sanction, but they will be the responsibility of the most senior operational management and reported upon at the executive level.
- **Medium** risks can be expected to form part of routine operations, but they will be explicitly assigned to relevant managers for action, maintained under review and reported upon at senior management level.
- **Low** risks will be maintained under review, but it is expected that existing controls are sufficient, and no further action is required unless they become more severe.

To ensure that climate change risks are appropriately managed, all risks should be assigned to a risk owner or business area for accountability.

## 4.3 Reviewing risk controls & treatments

Each climate change risk to buildings and homes will likely occur in the context of existing control measures and treatments that have already been implemented or are already in place. As the New Zealand government, businesses, and communities seek to adapt to climate change risks, changes in policy, building standards, and design processes are progressively controlling and treating potential climate change risks.

Site specific existing controls and treatments may include changes in building position during site selection, choices in building materials, and engineering of building components to effectively cope with climate conditions. Examples of existing risk controls and treatments include:

- Land-use planning and site location – avoidance of highly exposed locations such as known floodplains, coastal erosion zones, and areas subject to sea-level rise.
- Structure and performance – increasing the standard, quality, durability, or functionality of building elements to reduce vulnerability to current and future climate change hazards.
- Design and engineering – implementing engineering-based controls, such as increasing floor levels and increasing stormwater systems to reduce exposure and vulnerability to current and future climate change hazards.
- Operation and maintenance – ensuring inspection and maintenance of building elements and systems over time to sustain adaptive capacity of elements at risk.

A risk assessment should acknowledge the effectiveness of existing risk controls and treatments that have been incorporated into a building or home. This will provide transparency for how certain hazards are managed and whether they are suitable in a changing environment.

Existing risk controls and treatments may be rated using the example criteria provided in Table 8.

Table 8: Example control and treatment effectiveness criteria

	Description
Substantially effective	Existing controls address risk, are in operation and are applied consistently. Management is confident that the controls are effective and reliable. Ongoing monitoring and adaptive management is required.
Partially effective	Controls are only partially effective, require ongoing monitoring and may need to be redesigned, improved or supplemented.
Largely ineffective	Management cannot be confident that any degree of risk modification is being achieved. Controls need to be redesigned.

## 5.0 Adaptation Planning

Stage: Adaptation Planning

Objective	Actions
Develop a climate adaptation plan to outline the responses to identified climate-related risks	Using outcomes from the risk assessment process, develop an adaptation plan to manage climate change risks over time
Outcomes	A climate change adaptation plan

The adaptation planning stage uses the outcomes from the risk assessment to form a climate change adaptation plan for a building or home.

An adaptation plan should include actions and solutions for the building and home that specifically address high and extreme risks identified in the risk assessment process. Actions should be clearly stated and assigned to an accountable owner to ensure they are managed, monitored, and reviewed over time, acknowledging the inherent uncertainties when responding to climate change risks.

The 'Climate Change Risk & Adaptation Workbook' in Appendix B provides an example climate change

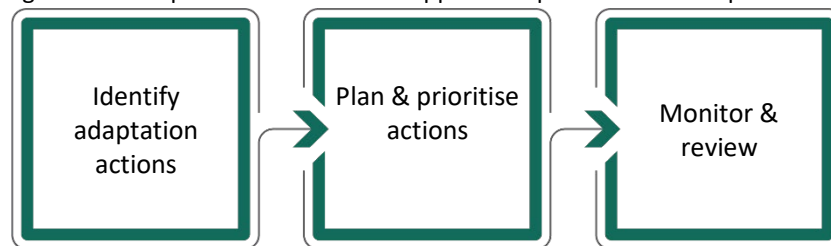


Figure 5: Work process for adaptation planning stage

adaptation plan template.

### 5.1 Identifying adaptation approaches

Where existing control and treatments for climate change risks are deemed partially effective or largely ineffective for high and extreme rated risks, planning for additional adaptation action is necessary.

Adaptation actions can incorporate a combination of 'hard' and 'soft' approaches to address risks, as shown in Table 9. To effectively address climate change risks, adaptation actions should be considered that target either or both:

- Risk exposure - Targeted actions and interventions to the location and setting of the element at risk to reduce the presence of hazards.
- Risk vulnerability - Targeted actions and interventions to the elements at risk to reduce the sensitivity to a hazard occurring or increase its adaptive capacity.

As buildings and homes owners often have little influence or control over the exposure of a risk occurring beyond the property boundary, adaptation actions at this level commonly focus on reducing the vulnerability of elements at risk should a hazard occur.

Table 9: Approaches of climate change risk control and adaptation responses

Category	Description	Example Actions
----------	-------------	-----------------

Infrastructure & technological	Investment in physical assets and technological systems to address risks	<ul style="list-style-type: none"> <li>○ Increase robustness of building elements.</li> <li>○ Increase redundancy of building elements.</li> <li>○ Increase adaptability and modularity of building elements.</li> <li>○ Decrease cost of element failure.</li> </ul>
Organisation & Policy	Establishment of policies, procedures and management systems address risks	<ul style="list-style-type: none"> <li>○ Improve monitoring and maintenance.</li> <li>○ Implement early hazard warning systems.</li> <li>○ Integrate climate risks into depreciation and insurance policies.</li> <li>○ Adapt intended element lifespan.</li> <li>○ Improve emergency management and response practices.</li> </ul>
Behavioural & cultural	Building knowledge, skills, and capacity for users and key stakeholders to make climate-smart decisions	<ul style="list-style-type: none"> <li>○ Support community-led hazard planning.</li> <li>○ Increase climate risk engagement and education.</li> <li>○ Improve energy/resource use efficiency.</li> </ul>
Nature-based	Using natural systems and ecosystem services to address climate-related risks and generate co-benefits	<ul style="list-style-type: none"> <li>○ Integrate nature-based solutions into build form.</li> <li>○ Increase vegetation and shading.</li> </ul>

## 5.2 Planning and prioritising adaptation action

For each climate change risk assessed for a building or home there are likely to be multiple adaptation actions that could be used to control or treat the risk. In general, risks rated extreme and high will need to be addressed immediately or subjected to more detailed analysis. Low ranked risks, on the other hand, will generally be acknowledged with no further action required to address them immediately. Low ranked risk can be reviewed periodically or by exception (e.g. following an extreme weather event) to ensure that there has been no change that would make them more serious.

### Adaptation resource requirements

When planning adaptation actions to address climate change risks, it is important to determine the resources that will be required. The following key resource requirements must be considered:

- Personnel - who will be responsible for implementing the adaptation action?
- Physical implications – what assets and resources does your organisation own that are required or involved with the implementation of the adaptation action?
- Financial – what funding is required to implement the adaptation action and are additional funding activities or approvals (e.g. *loan approval*) required to obtain this funding?
- Information – what information does your organisation require to ensure the adaptation action effectively addresses the risk?

### Adaptive risk management & adaptation pathways

As climate change risks may change from low or acceptable at present, to high and unacceptable in future timeframes, building and home adaptation plans should be developed to manage risks adaptively over time.

When able to be used, adaptive risk management approaches provide a practical and cost-effective approach for building and homeowners to deal with climate change uncertainties. Adaptive risk management aims to put in place small, flexible, incremental changes based on regular monitoring and revision of plans using

information available at the time, rather than relying on one-off, large-scale treatments that may prove ineffective or inflexible.

Adaptive risk management allows for flexible decision-making as new information becomes available about the nature of climate change risks, ensuring that actions taken today preserve the viability of future actions should they be required.

Adaptive risk management can be planned for using a climate change adaptation pathways approach to organising adaptation actions. Adaptation pathways approaches do this by linking current and potential future actions into logical implementation pathways and using signals and triggers. This helps to inform when change in adaptation action is needed to avoid or reduce potential negative consequences.

Signals and triggers for change can be based on various factors, such as specific climate variables, economic indicators, or structural indicators, as shown in Figure 6.

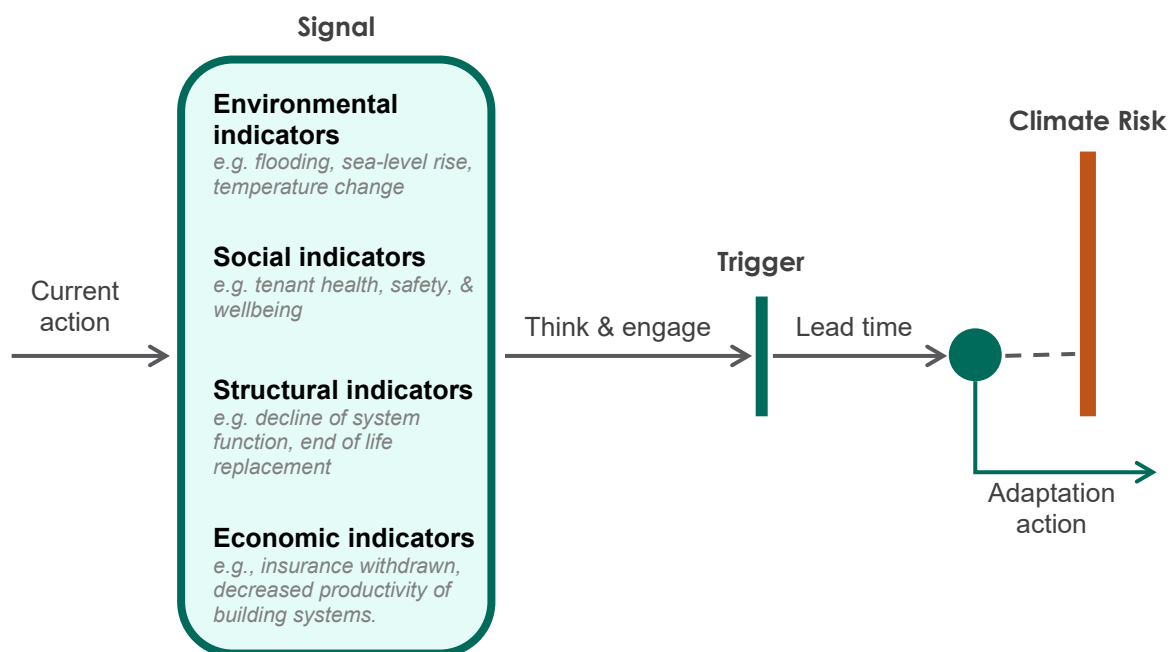


Figure 6: Types of indicators that can be used for adaptation signals and triggers for adaptation pathways

### 5.3 Monitoring & reviewing adaptation plans

Adaptation plans should be seen as ‘living documents’ that are reviewed on a regular basis and updated as necessary to take changing circumstances or information into account.

Regular monitoring and review by building managers and homeowners is important for supporting adaptation planning and delivery over time. Monitoring and review will help inform when adaptation actions are achieving the intended outcomes, or when additional action may be required to address an increasing risk.

When planning the monitoring and review metrics within an adaptation plan, the following attributes should be considered:

- The purpose of the monitoring metric - what is being monitored and why?
- The resources available including appropriate detail on the allocation of resources required and timing expectations on how long ongoing monitoring will take place and the frequency to which progress is evaluated.
- Accountability - who will be accountable for managing and executing the monitoring and evaluation activities (e.g. a person or team within the organisation).
- Governance - who will need to be regularly updated on progress and what are the reporting requirements that need to be fulfilled (e.g. senior stakeholders, committees).
- Documentation – what analysis methodology and data sources will be used to measure progress including any implicit assumptions.
- Performance indicators - determine thresholds for the metrics to be used to measure progress in conjunction with the anticipated timeframe that you are monitoring that can indicate whether progress is ahead of track, on track, or falling behind schedule.
- Review approach - determine the review approach, frequency, and timing for making any interim changes to any exposure or vulnerability within your risk register. The approach, frequency, and timing of the review should take into account the likely timing for replacement of building elements or potential triggers for review by exception (e.g. premature failure or loss of a building element).

Periodic reviews of all risks and opportunities should already be an existing practice within the risk management function of your organisation and will ideally involve a committee that has the delegation to make decisions on any changes to risks or opportunities including any existing or proposed actions for their management.



# References & Appendices

## 6.0 Key Terms

Table 10: Key climate change related terms and definitions have been sourced from the Intergovernmental Panel on Climate Change, Climate Change 2023: Synthesis Report

Term	Definition
Adaptation	In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.
Adaptive Capacity	The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences
Exposure	The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.
Hazard	The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources
Impacts	The consequences of realised risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather/climate events), exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Impacts may be referred to as consequences or outcomes and can be adverse or beneficial.
Shared Socio-Economic Pathways (SSPs)	Shared socio-economic pathways (SSPs) have been developed to complement the Representative Concentration Pathways (RCPs). By design, the RCP emission and concentration pathways were stripped of their association with a certain socio-economic development. Different levels of emissions and climate change along the dimension of the RCPs can hence be explored against the backdrop of different socio-economic development pathways (SSPs) on the other dimension in a matrix.
Resilience	The capacity of interconnected social, economic, and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation.
Risk	The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and well-being, economic, social, and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species.
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

## 7.0 References

Extreme sea level flood maps (1% AEP and up to 2m sea-level rise) for Aotearoa by referencing this publication as appropriate: Paulik, R., Wild, A., Stephens, S., Welsh, R., Wadhwa, S. 2023. National assessment of extreme sea-level driven inundation under rising sea levels. *Frontiers in Environmental Science*, 10, 2633, <https://doi.org/10.3389/fenvs.2022.1045743>.

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New Zealand Green Building Council. 2023. Climate Scenarios for the Construction and Property Sector | Ngā Horopaki Āhuarangi mō te Rāngai Hanganga me ngā Whare.

Urban Intelligence. 2024. National infrastructure exposure and property isolation assessment

## Appendix A: Climate Change Resources

Appendix A contains information of the climate change information resources publicly available to support a climate change risk assessment and adaptation planning process.

### New Zealand Climate Projections Map



[New Zealand Climate Projections Map | Ministry for the Environment](#)

#### Data parameters:

The New Zealand Climate Projections Map shows projected future changes to temperature, rainfall, and wind using the most recent SSP scenarios at a 5 km resolution. Three climate change scenarios are available in this dataset: SSP1-2.6, SSP2-4.5, and SSP3-7.0.

Three future time periods (2021-2040, 2041-2060 and 2081-2100) are available in the dataset. These allow users to view climate projections for the near-term future, mid-century and end-of-century periods. Two historical baselines (1986-2005 and 1995-2014) are available in the dataset. The data for these baselines represent the average climate conditions in the recent past.

- The 1986-2005 baseline was used for the previous projections for New Zealand (i.e. the RCP scenarios).
- The 1995-2014 baseline is consistent with the IPCC Sixth Assessment Report.

#### How to use:

1. Select a climate variable in the left-hand panel. Note, to align with the Green Star and Homestar requirement to use RCP8.5 projections, it is recommended that SSP3-7.0 is used.
2. Use the right-hand pane to choose the historical base period, the climate change scenario, and future period, and season for which you would like to see the projection.
3. Each tile on the map represents a 5 km by 5 km area. The colour of the tile provides an indication of the magnitude of change, with higher colour intensity indicating higher degrees of change.
4. Move the map by dragging it with a mouse or using arrow keys on a keyboard. To zoom, double click on a location. You can also use mouse scroll wheel, use the +/- buttons on the map, or use +/- keys on your keyboard to zoom in and out.
5. To display the specific value for your property, locate your location on the map and click the tile.

The data for each variable is available to be downloaded from the following [link](#). The climate projections data is freely accessible under [this license](#) and subject to [this acceptable use policy](#).

Table 11: Climate variables available in the New Zealand Climate Projections Map

	Climate Variable	Description
Temp	Average daily air temperature	The average daily air temperature per year or season. The daily minimum and maximum temperatures and the daily temperature range variables are also available (°C)

Temperature	Hot Days	The number of days per year or season with a maximum daily air temperature over 25°C
	Very Hot Days	The number of days per year or season with a maximum daily air temperature over 30°C
	Frost Days	The number of days per year or season with a minimum daily air temperature below 0°C
	Temperature on the Hottest Day	The maximum daily air temperature per year
	Temperature on the Coldest Day	The minimum daily air temperature per year
	Growing Degree Days	The accumulated daily temperature above a base threshold (5°C and 10°C) per year, indicating the amount of warmth available for plant growth
	Cooling Degree Days	The annual accumulated daily temperature above 18°C - considered a 'comfortable' temperature - and so cooling of buildings may be required
	Heating Degree Days	The annual accumulated daily temperature below 18°C - considered a 'comfortable' temperature - and so heating of buildings may be required
	Average Relative Humidity	The average daily relative humidity per year or season (%)
	Average Solar Radiation	The average daily incoming solar radiation per year or season (W/m <sup>2</sup> )
Rainfall	Total Rainfall	The total amount of rainfall per year or season (%)
	Rainy Days	The number of days per year or season with 1 mm or more of rainfall
	Very Rainy Days	The number of days per year or season with more than 25 mm of rainfall
	Heavy Rainfall	The 99th percentile of all daily rainfall over each 20-year period (%)
	Dry Days	The number of days with less than 1 mm of rainfall
	Drought Exposure	Potential evapotranspiration deficit (PED) is a drought index. It is the gap between water demand and water availability (mm)
Wind	Average Wind Speed	The average daily wind speed at 10 metres above the ground (%)
	Windy Days	The number of days with maximum wind speed more than 10 metres per second
	Strong Wind	The 99th percentile of all maximum daily wind speeds over each 20-year period (%)

## Sea-Level Rise & Vertical Land Movement Data

### [Sea-Level Rise Maps for Planners | NZ Sea Rise](#)

#### Data parameters:

The NZ SeaRise Map shows how much sea-level could rise at different locations around the coast of New Zealand, using the most recent SSP scenarios and vertical land movement measurements at 2km intervals. Because New Zealand is such a tectonically active country, measures of vertical land movement need to be considered alongside sea-level rise. Low lying areas of coastline that are subsiding will experience impacts of sea-level rise at a quicker rate.

Scenario projection timeframes from present day to 2150 are available in the dataset. NZ SeaRise projections use a historical baseline of 1995-2014 to represent the average sea-level in the recent past.

### How to use

1. Hover your cursor over the coloured dots on the map and select your project location.
2. Use the left-hand pane to choose the climate change scenario and if you will include vertical land movement in your analysis. Note, to align with the Green Star and Homestar requirement to use RCP8.5 projections, it is recommended that SSP3-7.0 or SSP5-8.5 is used
3. Each coloured dot on the map represents a 2 km area of coastline. The colour of the dot provides an indication of the magnitude of change, with darker blue indicating higher levels of subsidence and darker red indicating higher levels of uplift.
4. Use the graph generated to identify the measure of relative sea-level rise for your project location.

## Sea-Level Rise & Extreme Coastal Flood Maps

### [Extreme coastal flood maps for Aotearoa New Zealand | NIWA](#)

#### Data parameters:

The NIWA Coastal Flood Layers Viewer maps and data provide a spatially modelled representation of New Zealand's 1% AEP (Annual Exceedance Probability) extreme sea-level flooding under relative sea-level rise scenarios up to 2m above present-day mean sea level.

1% AEP means conditions that have a 1% chance of occurring in any given year (i.e., an average likelihood of occurring once every 100 years). In the case of coastal flooding, these conditions are likely to happen during a storm event with large tides, waves and storm surge.

Scenario projection timeframes from present day to 2150 are available in the dataset. Three historical baselines (1986-2005; 1995-2014; and Year 2020) are available in the dataset.

#### How to use:



1. Use the right-hand pane to choose your baseline period, SSP scenario, target year, and level of vertical land movement for your project location. This information can be acquired using the NZ SeaRise Map. Note, to align with the Green Star and Homestar requirement to use RCP8.5 projections, it is recommended that SSP3-7.0 or SSP5-8.5 is used
2. Use the search function in the map on the left-hand pane to locate your project location.
3. Use the slide bar at the bottom of the map to select the amount of sea-level rise for your project location.
4. Use the right-hand pane to choose the historical base period, the climate change scenario, and future period, and season for which you would like to see the projection.
5. Move the map by dragging it with a mouse or using arrow keys on a keyboard. To zoom, double click on a location. You can also use mouse scroll wheel, use the +/- buttons on the map, or use +/- keys on your keyboard to zoom in and out. Note, the sea-level rise layer is visible down to a 200m map resolution.


In addition to the 1% AEP scenario provided here, NIWA has also mapped 39, 18, 10, 5, 2, 1, 0.5, 0.2 and 0.1 % AEP scenarios (equivalent to return periods of 2, 5, 10, 20, 50, 100, 200, 500 and 1000-years).

All of these scenarios have additional RSLR increments added up to 2 m above present-day mean sea level. [These additional ARCGIS layers are available here.](#)

## High Intensity Rainfall Data

### [High Intensity Rainfall System V4 | NIWA](#)

#### Data parameters:


 NIWA's High Intensity Rainfall Design System (HIRDS) estimates high intensity rainfall at any location across New Zealand for a range of return periods and event durations, using four representative concentration pathway (RCP) scenarios.

The depth-duration-frequency tables produced can be used for design storm assessment and for the design of flood protection works and other waterway structures. The DDF tables are also applicable to flood modelling, including flood routing, retention basin design and inundation mapping activities

Two future time periods (2031-2050 and 2081-2100) are available in the dataset. A historical baseline of 1986-2005 are available in the dataset.

#### How to use:

1. Select your project location by either searching using the Address Search, clicking anywhere on the map, clicking one of the rain gauge locations, or entering the latitude, longitude and name.
2. Select output format:
  - depth-duration-frequency returns the amount of rain fallen during the event (in mm).
  - intensity-duration-frequency returns the average rate of rainfall during the event (in mm/hr).

 3. Press 'Generate Report'. After a short delay the results will appear below the map in a series of tabs and as a downloadable spreadsheet.

## Flood Hazards (1% AEP Rainfall Event) Maps

### [Flood hazards across Aotearoa New Zealand | Earth Sciences New Zealand](#)

#### Data parameters:

The Earth Sciences New Zealand flood hazard map shows locations exposed to 1% annual exceedance probability (AEP) flooding – also described as a severity expected to occur (or be exceeded), on average, once every 100 years, across New Zealand.

You can use the drop downs at the top right of the screen to view each of New Zealand's regions, or to look at how this flood risk changes as our climate warms – with 1, 2 and 3 degrees of warming compared with our current climate. Based on the latest climate projections for New Zealand, 1°C of additional warming may occur between 2029 under a higher emissions scenario (SSP5-8.5) and 2042 under a low scenario (SSP1-2.6), 2°C of additional warming between 2056 (SSP5-8.5) and 2074 (SSP2-4.5) and 3°C from around 2076 (SSP5-8.5).

#### How to use:









1. Use the bottom right-hand pane search information available on the platform for exposure and climate scenarios.
2. Using the map layers widget in the map on the right-hand pane, select the climate change warming scenario (1, 2, 3°C warming).
3. Move the map by dragging it with a mouse or using arrow keys on a keyboard. To zoom, double click on a location. You can also use mouse scroll wheel, use the +/- buttons on the map, or use +/- keys on your keyboard to zoom in and out. Note, flood hazard layers is visible down to a 200m map resolution.

The main purpose of this nationally consistent 1% AEP rainfall flood hazard viewer is to identify national and regional level flood hazard and exposure, now and as our climate warms. It provides a bird's-eye view across the country (down to street level) to identify areas most at risk. This tool was not designed for hazard and exposure analysis at higher resolutions. Many councils have created or developing high-resolution maps of flooding exposure for this purpose.

Note, flood inundation modelling was not done in some locations, either because these are upper parts of catchments where flooding would be expected to be confined to close to the river, or because LiDAR data was not available at the time of modelling (up to December 2024).

## Regional & Territorial Coastal Flood Maps

Several councils across New Zealand provide coastal hazard maps for their area and, in many cases, these are higher resolution than the NIWA maps.

-  [Auckland Council](#)
-  [Bay of Plenty Regional Council](#)
-  [Nelson City Council](#)
-  [Northland Regional Council](#)
-  [Tasman District Council](#)
-  [Waikato Regional Council](#)
-  [Wellington Regional Council](#)
-  [Thames Coromandel District Council](#)

## Regional Climate Change Technical Reports

A number of New Zealand regional councils and territorial authorities have previously commissioned the analysis of regional-scale high resolution (5 km x 5 km) climate change projection maps and produced detailed reports. Note, these reports predominantly show climate change projections for a large range of climate variables using 2040 and 2090 timeframes and climate change scenarios RCP4.5 and RCP8.5.

### Auckland Council

- [Summary report \(2018\)](#)
- [Full technical report \(2018, revised 2020\)](#)

### BOP Regional Council

-  [Full technical report \(2019\)](#)

### Environment Canterbury

-  [Full technical report \(2020\)](#)

### Environment Southland, Gore District Council, Invercargill City Council, and Southland District Council

-  [Full technical report \(2018\)](#)

### Greater Wellington Regional Council

- [Summary report \(2017\)](#)
-  [Full technical report \(2017\)](#)
- [Climate change extremes report \(2019\)](#)

### Gisborne District Council and Hawke's Bay Regional Council

-  [Full technical report \(2020\)](#)

Horizons Regional Council

- [Full technical report \(2016\)](#)
- [Climate change implications for Manawatu-Whanganui \(2019\)](#)



Kaipara District Council

- [Full technical report \(2020\)](#)



Marlborough District Council



- [Full technical report \(2021\)](#)

Northland Regional Council



- [Full technical report \(2016\)](#)

Otago Regional Council



- [Full technical report \(2019\)](#)

Taranaki Regional Council



- [Full technical report \(2022\)](#)

Tasman District Council



- [Full technical report \(2015\)](#)

- [Climate change impacts on agricultural systems in Tasman \(2019\)](#)

Waikariri District Council



- [Summary report \(2022\)](#)



- [Full technical report \(2022\)](#)

Waipapa



- [Climate change projections report \(2021\)](#)



## Appendix B: Climate Change Risk & Adaptation Workbook

The Climate Change Risk & Adaptation Workbook is provided in a separate Microsoft Excel document to this guidance.

