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Climate Change Resilience for Green Star Projects

Technical Guidance for Climate Change Risk Assessment & Adaptation Planning for Green Star Projects

greenstar

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1.0 Introduction

This technical guidance has been developed to support project teams in applying the New Zealand Green Building Council (NZGBC) Climate Change Resilience for Buildings and Homes Guidance to meet the requirements of the Green Star Buildings Credit 16 - Climate Change Resilience, and Green Star Design and As Built v1.0 and v1.1 Credit 3 – Adaptation and Resilience (collectively referred to hereafter as Green Star projects).

This technical guidance for Green Star projects should be read in conjunction with the NZGBC Climate Change Resilience in Buildings & Homes: Guidance for Climate Change Risk Assessment & Adaptation Planning document.

The NZGBC Climate Change Resilience for Buildings and Homes document sets out a four-stage process to carry out a climate change risk assessment and develop an adaptation plan for a building or home in New Zealand. It is consistent with both 'Arotakenga Huringa Āhuarangi: A Framework for the National Climate Change Risk Assessment for Aotearoa New Zealand'[1] and 'He kupu ārahi mō te aromatawai tūraru huringa āhuarangi ā-rohe A guide to local climate change risk assessments'.[2]

1.1 Purpose of this technical guidance

The purpose of this guidance for Green Star projects is to translate the framework and tools provided in the NZGBC Climate Change Resilience for Buildings and Homes document to support project teams to meet the requirements of Green Star Buildings Credit 16 – Climate Change Resilience and Green Star Design and As Built Credit 3 – Adaptation and Resilience.

This technical guidance was developed to reduce the risk for Green Star project teams that pursue these credits. Through engagement with Green Star users and assessors, it was determined that transparency is one of the most important aspects to successfully meet the requirements of Green Star climate change resilience credits. Project teams are strongly encouraged to transparently demonstrate how climate change risks are identified and addressed throughout a project's lifecycle.

It seeks to provide clear technical guidance for completing the Climate Change Pre-screening Checklist, Climate Change Risk Assessment, and Climate Adaptation Plan in a manner that satisfies Green Star requirements. It clarifies the minimum expectations for climate change data, hazards, risk elements, and evidence required for credit achievement.

[1] Ministry for the Environment. 2019. Arotakenga Huringa Āhuarangi: A Framework for the National Climate Change Risk Assessment for Aotearoa New Zealand. Wellington: Ministry for the Environment.

[2] Ministry for the Environment. 2021. He kupu ārahi mō te aromatawai tūraru huringa āhuarangi ā-rohe / A guide to local climate change risk assessments. Wellington: Ministry for the Environment.

2.0 Green Star Credit Requirements

The Green Star climate change resilience credit seeks to ensure that buildings have been designed and constructed to respond to both direct and indirect impacts of climate change over their anticipated lifespan.

The structure and requirements of the Green Star Buildings credit are summarised in Table 1 below. The Green Star Design and As Built v1.1 credit is similar to these requirements.

As described in the submission guidelines for Green Star Buildings and Green Star Design and As Built, if a project meets the requirements for Credit Achievement (completion of a Climate Change Risk Assessment and Climate Adaptation Plan), then the requirement to complete the Climate Change Pre-screening Checklist is considered to have been met. i.e., The project team is not required to submit a Climate Change Pre-screening Checklist.

Table 1: Green Star Buildings Credit 16 Climate Change Resilience overview

Name	Climate Change Resilience
Outcome	The building has been built to respond to the direct and indirect impacts of climate change
Credit Criteria	
Minimum Expectation	At a minimum, the project team must complete the Climate Change Pre-screening Checklist. The project team must communicate the building's exposure to climate change hazards, and any identified risks to the client/building owner. Points Available: Nil
Credit Achievement	To gain 1 point, in addition to the Minimum Expectation: i. A project-specific Climate Change Risk Assessment has been developed and implemented in accordance with a recognised standard. ii. A Climate Adaptation Plan has been developed and implemented, including solutions for the building design and construction, that specifically address key risks identified in the Climate Change Risk Assessment. Points Available: 1
Additional Information	
Related Credits	• Energy Use (Credit 22) • Lifecycle Impacts (Credit 26) • Operations Resilience (Credit 17) • Community Resilience (Credit 18) • Contribution to Place (Credit 29) • Impacts to Nature (Credit 35)
SDG Alignment	• Goal 11: Sustainable Cities and Communities • Goal 13: Climate Action

2.1 Green Star credit alignment with the risk assessment and adaptation planning process

The NZGBC Climate Change Resilience for Buildings and Homes document sets out a four-stage process to carry out a climate change risk assessment and develop an adaptation plan for a building or home. Figure 1

below shows the alignment between the four NZGBC guidance stages and the requirements for the Green Star climate change resilience credits.

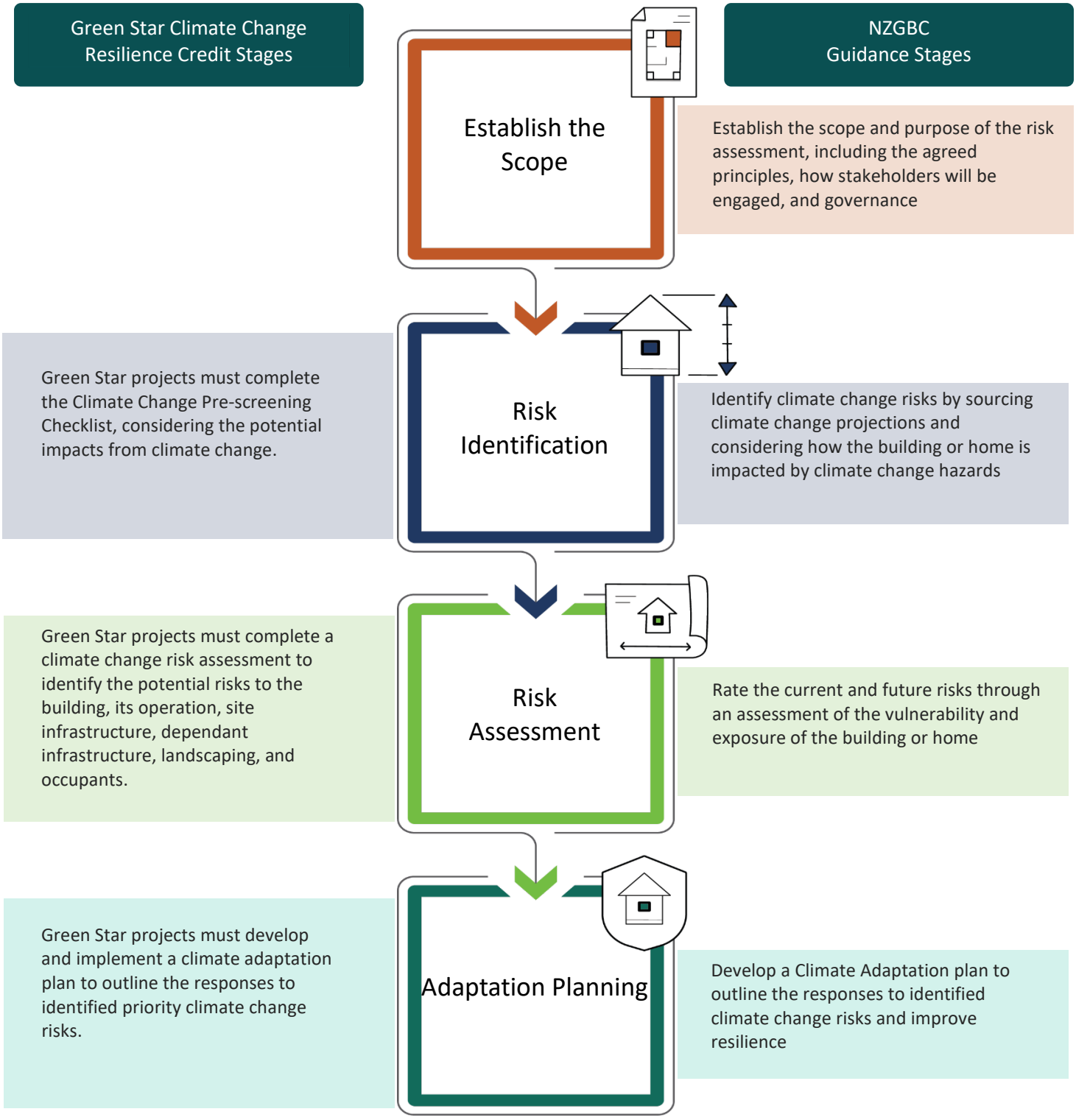

Figure 1: Alignment between the NZGBC Climate Change Resilience for Buildings and Homes document stages and Green Star Buildings Credit 16 Climate Change Resilience requirements

3.0 Climate Change Resilience Credit Stages

3.1 Climate Change Pre-screening Checklist

The Climate Change Pre-screening Checklist is intended to prompt early consideration of climate change risks and adaptation actions in a project. Completion of the Pre-screening Checklist is a minimum expectation for projects to comply with Green Star project requirements.

Project teams must indicate 'Yes' or 'No' in the Pre-screening Checklist and not leave any rows blank. This is where the project identifies if the risk is relevant to the project. If 'Yes' is indicated for a question, project teams are expected to insert a note providing further explanation to the question.

In the Pre-screening Checklist, project teams must consider potential impacts from climate change when completing the checklist in their submission form. The potential impacts that must be considered include, but are not limited to:

- Direct damage or failure of project components, such as roof damage due to flooding from internal gutters.
- Accelerated deterioration of project components or reduced design life. For example, increasing rate of deterioration of rubber seals on windows resulting in a short lifespan.
- Reduced operating capacity or impacts on operations. For example, building users are unable to safely enter or leave the site due to flooding.
- Climate hazard impacts to surrounding areas, such as flooding on access roads and pathways to the site.
- Impacts to the health and wellbeing of building occupants and other relevant stakeholders. For example, increased risk of heat stress due to high working temperatures.
- Indirect risks from impacts to other interdependent systems and services (e.g. transport networks, power, water, telecommunications). For example, loss of electricity due to impacts on the local network infrastructure during extreme winds.

Both historic and future climate change and hazard data should be used when completing the checklist.

Appendix A of this technical guidance provides an example of responses that are suitable to meet the expectations of the Climate Change Pre-screening Checklist for Green Star projects.

Using the NZGBC Guidance for the Climate Change Pre-screening Checklist

Section 3.0 Identifying Climate Change Risks in the NZGBC Climate Change Resilience for Buildings and Homes document provides Green Star users with support to complete the Climate Change Pre-screening Checklist. Like the pre-screening checklist, the Risk Identification stage seeks to prompt early consideration of a building'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 the building.

The 'Climate Change Risk Identification Matrix' example template provided in the 'Climate Change Risk & Adaptation Workbook' can be used to identify potential climate change risks and inform a Green Star user's response in the Climate Change Pre-screening Checklist. A 'Climate Change Pre-screening Checklist' template is also available within the workbook.

- Green Star credit achievement requirements to observe #1: Selecting climate change scenarios and timeframes

  Green Star requires that project teams must use at a minimum Representative Concentration Pathway (RCP) 8.5 as specified in the Intergovernmental Panel on Climate Change (IPCC) Fifth

Assessment Report or any newer version (e.g. SSP3-7.0), at two time horizons (e.g. 2050 and 2100) that are relevant to the project's anticipated lifespan.

The NZGBC Climate Change Resilience for Buildings and Homes document contains information of the climate change resources publicly available to support a climate change risk assessment and adaptation planning process. The project must justify the selection of the climate change projections and RCP (or SSP) scenario used (noting RCP 8.5 or equivalent as a minimum should be used). Project teams are strongly encouraged to use SSP3-7.0 in lieu of RCP 8.5 where able.

- Green Star credit achievement requirements to observe #2: Climate change hazards to consider

  Green Star requires that project teams must consider at a minimum, but not limited to, the following climate change hazards:

  - Sea-level rise and coastal inundation.
  - Increase in rainfall and flooding.
  - Solar radiation.
  - Temperature increase (including heat island effect).
  - Extreme weather conditions (including wind and storms).
  - Subsidence or ground movement.
  - Groundwater rise and potential for increased liquefaction vulnerability.
  - Increase in potential for fire weather and drought.

  These climate change hazards are included in the 'Climate Change Risk Identification Matrix' example template provided in the 'Climate Change Risk & Adaptation Workbook'. Section 3.0 Identifying Climate Change Risks in the NZGBC Climate Change Resilience for Buildings and Homes document provides further guidance for understanding and sourcing information for these climate change hazards.

  For transparency, where a climate change hazard listed above is assessed as not posing a potential risk to any building element, Green Star project teams should provide comments explaining the rationale in the space provided. For example, where a building is not located near the coast, or is located on flat ground with no potential for landslide, these features should be explained. This will support the Green Star assessor to ensure that mandatory climate change hazards have not been overlooked.

3.2 Climate change risk assessment

To partly achieve the one credit point for climate change resilience credits, a project-specific climate change risk assessment must be completed by a suitably qualified professional using a recognised methodology.

To comply with Green Star project requirements, the climate change risk assessment must contain at a minimum, the following information:

- A summary of the project's characteristics (e.g. site, location, climatic characteristics).
- A summary of locally relevant climate change projections and associated hazards (noting the minimum requirements for climate change scenarios, timeframes, and hazards detailed in the previous section). For example, relevant climate change projections may include average temperature changes, extreme temperature changes (i.e. number of hot days), extreme rainfall depth changes (e.g. 1% AEP 24-hour rainfall depth), and coastal hazards such as relative sea-level rise and coastal erosion.
- Identification of the potential risks to the building, its operation, site infrastructure, dependant infrastructure, landscaping, and occupants.

The climate change risk assessment should include a register of risks to the building and related elements, capturing the risk ratings, justifications for ratings, and related treatment options for 'high' and 'extreme' climate change risks.

Using the NZGBC Guidance for a climate change risk assessment

Section 4.0 Assessing Climate Change Risks in the NZGBC Climate Change Resilience for Buildings and Homes document provides Green Star users with support to complete a climate change risk assessment. The risk assessment stage assigns risk ratings to the identified climate change risks, taking into account each of the climate change scenarios and timeframes required for the risk assessment.

The 'Climate Change Risk Assessment Register' example template provided in the 'Climate Change Risk & Adaptation Workbook' can be used to document and detail the identified climate change risks for a Green Star user's response.

- Green Star credit achievement requirements to observe #3: Risk elements to consider

  Green Star requires that, at a minimum, but not limited to, a project should consider the following risk elements in a climate change risk assessment:

  - Building envelope and building structure (e.g., cladding, glazing and roof).
  - Site infrastructure (e.g. stormwater, wastewater systems).
  - Flood resilience (e.g. pluvial, fluvial or coastal flood risk).
  - Building operating systems (e.g. electrics, power and telecommunications, specialised electronic equipment).
  - Occupants (e.g. the indoor environment is designed for appropriate thermal comfort for occupants).
  - Landscaping/external space (e.g. heat island effect).
  - Dependant infrastructure (e.g. transport networks, power, water, telecommunications).

  These risk elements are included in the 'Climate Change Risk Identification Matrix' example template provided in the 'Climate Change Risk & Adaptation Workbook'.

  For transparency, where a risk element listed above is assessed as not being exposed or vulnerable to any climate change hazards, Green Star users should provide comments explaining the rationale in the space provided. This will support the Green Star assessor to ensure that mandatory risk elements have not been overlooked.

  For example, where a building is not located near the coast, or is located on flat ground with no potential for landslide, these features should be explained. Similarly, for flood risk, if the specific design of the building or site has resulted in reducing or removing the flood hazard, then this should be clearly explained.

- Green Star credit achievement requirements to observe #4: Using a recognised risk assessment approach

  For the Green Star credit, the following recognised approaches can be used to undertake the risk assessment:

  - Ministry for the Environment, 2021: A Guide to Local Climate Change Risk Assessments.
  - Australian Standard 5334:2013: Climate change adaptation for settlements and infrastructure - A risk based approach.
  - Australian Greenhouse Office, 2006: Climate Change Risks and Impacts: A Guide for Government and Business.

The NZGBC Climate Change Resilience for Buildings and Homes document is consistent with the Ministry for the Environment 2021: A Guide to Local Climate Change Risk Assessments.

- Green Star credit achievement requirements to observe #5: Using a suitably qualified professional

  A suitably qualified professional is required to develop a project-specific Climate Change Risk Assessment and develop a project-specific Climate Change Adaptation Plan.[3] For the purposes of this Green Star credit, a suitably qualified professional is defined as someone in a relevant field such as Environmental Science, Environmental Engineering, Planning or similar qualification, with at least three years' practical experience in climate change risk assessments, or an individual supervised by a suitably qualified practitioner or a business with verified practitioner capability.

[3] A suitably qualified professional is not required for projects only completing the Climate Change Pre-screening Checklist.

3.3 Climate adaptation plan

To fully achieve the one credit point for Climate Change Resilience, a project-specific climate adaptation plan must be developed and implemented. A climate adaptation plan should outline the responses to identified priority risks for the building.

To comply with Green Star Building requirements, a climate adaptation must consider at a minimum, the responses to 'high' and 'extreme' rated climate change risks and contain the following information:

- The climate change risk assessment, described in the previous section.
- A risk register of all potential risks identified to the building, its operation, and occupants.
- Specific adaptation design responses for all risks identified as 'high' or 'extreme', and associated responsibilities for action.
- Governance strategies to ensure the implementation of design specific adaptation measures are delivered upon.
- Details of stakeholder consultation that was undertaken during preparation of the Climate Adaptation Plan and how the issues raised have been incorporated.

If no 'high' or 'extreme' risks are identified, then this would indicate the building has been designed to an appropriate standard of climate resilience. The justifications for risk ratings should be captured within the risk assessment to provide the necessary evidence required for this credit. In this instance, no adaptation design responses will be required.

Justifications should be technically accurate and detailed. For instance, while a hypothetical building is projected to be exposed to impacts from extreme rainfall in the future, its gutter systems have been designed suitably to cope with the appropriate extreme rainfall event (e.g. a 1% AEP 24-hour rainfall), with an allowance for climate change reflecting SSP3-7.0 at end of life.

- For example, "future rainfall intensities for the 1 in 100 year storm (1% AEP) are predicted to be 125mm/hour at 50 years (i.e. the building's lifespan). The building's gutters have a lifespan of 25 years and have been designed to manage up to 112mm/hour. Long-term risk is assumed reduced due to replacement gutters having the capacity for the next 25 years based on the equivalent of SSP3-7.0 projections at that time. This information will be transferred to the Facilities Manage through the building user information."

Using the NZGBC Guidance for a climate change risk assessment

Section 5.0 Adaptation Planning in the NZGBC Climate Change Resilience for Buildings and Homes document provides Green Star users with support to develop a climate adaptation plan. The adaptation planning stage uses the outcomes from the risk assessment to form a climate change adaptation plan for a building.

The 'Climate Adaptation Plan' example template provided in the 'Climate Change Risk & Adaptation Workbook' can be used to document and detail the responses to identified priority risks for the building.

4.0 Green Star Submission Content

Submissions for the Green Star Climate Change Resilience credit must contain both the Green Star submission form and evidence to support claims made in the submission. The example templates provided in the 'Climate Change Risk & Adaptation Workbook' from the NZGBC Climate Change Resilience for Buildings and Homes document can be used to evidence a climate change risk assessment and adaptation planning process, however other project specific information must be provided by the project team to meet credit requirements.

Table 2 below provides an overview of where 'Climate Change Risk & Adaptation Workbook' example templates can be used to evidence claims made in a Green Star submission.

Table 2: Overview of where 'Climate Change Risk & Adaptation Workbook' example templates can be used to support Green Star submission evidence recommendations.

Recommended evidence	Do the templates meet evidence requirements?	Further information
Climate Change Risk Assessment and Adaptation Plan, including local climate change projections, risk assessment criteria. Risk matrix, RCP and time horizon assumptions, any other assumptions significant in the development of the assessment, summary of key risks and adaptation responses.	In Part	The templates provided in the Climate Change Risk & Adaptation Workbook can be used to document and detail a climate change risk assessment process and adaptation plan action. However, an evidence submission should be supported by additional project specific information, including detail of the climate change projection data used, risk assessment matrix, and any assumptions or project specific context important to the risk and adaptation outcomes.
Climate Change Risk database / register.	In Full	The Climate Change Risk Assessment Register provides a sufficient database and register for an evidence submission.
Evidence of the adaptation responses being incorporated into the project design.	In Full	The Climate Change Risk Assessment Register and Climate Adaptation Plan templates provide space for users to detail existing risk controls, treatments, and rationale for risk ratings.
CV of the professional that developed the Climate Adaptation Plan.	Excluded	Additional project specific and team information should be provided to meet this evidence requirement.
Drawings and specifications demonstrating design responses.	Excluded	Additional project specific information should be provided to meet this evidence requirement.
Commissioning report or other technical document demonstrating design responses.	Excluded	Additional project specific or building operation information (e.g. building user guidance) should be provided to meet this evidence requirement.

Appendix A: Climate Change Pre-screening Checklist Example Response

Table 3: Example response for the Green Star Buildings Climate Change Pre-screening Checklist

Climate Change Pre-screening Checklist Criteria	Criteria response Yes/No	Comments If answered yes, provide further explanation
Have future climate change projections for the project location been reviewed based on relevant national or local climate projections?	Yes	A climate change risk assessment was undertaken in early 2026 using SSP3-7.0 for Auckland over three time horizons; present day-2040, 2041-2060, and 2081-2100. Future climate change projections that have been reviewed include temperature, rainfall, flooding, groundwater, coastal inundation, wind, and storms. Details of the climate change projections have been presented to the Client to clearly show the projected changes within the building lifespan as presented on pages 8-12 of this document.[4]
Has the project area been impacted previously by extreme climate events? Please indicate which events.	Yes	In January 2023 (Auckland Anniversary Weekend floods), the building's carpark was flooded due to excess surface water. This event was a 1 in 200 year storm event (0.5% AEP). Flooding during extreme weather events has been highlighted as an ongoing risk to the project, however adaptation measures were implemented as detailed in the response to the adaptation options question below.
Is the project located in or adjacent to a flood plain or flood prone area?	Yes	The project is located inside the council mapped 1% AEP flood plains and overland flow paths (including modelled climate change scenarios). Please refer to page 9 of this document for images.[5]

Climate Change Pre-screening Checklist Criteria	Criteria response Yes/No	Comments If answered yes, provide further explanation
Is the project located adjacent to the coastline, tidally influenced waterway, or within an area with	Yes	The project is not located adjacent to the coastline or a tidally influenced waterway.

[4] This is an example only - these pages have not been provided here. This demonstrates that project teams may provide project specific information on the climate change projections including relevant information reports, images, and maps.

potential for high or tidally influenced groundwater levels?		It is located in an area with high groundwater levels due to poor ground drainage, which means it is at increased risk of flooding during heavy rainfall events. This has been presented to the Client as a risk to the building during future heavy rainfall events, in line with the flooding seen during Auckland Anniversary Weekend floods.
Is the project located in an area with potential bushfire risk?	No	No, the project is located at an inner city site with a very low bushfire risk.
Have risks to the building elements, operation, or occupants been identified?	Yes	High intensity rainfall has been identified as having potential to impact gutter and onsite drainage. Damage or failure of these systems could lead to damage of the building, impact on operations, and health and wellbeing of workers due to inability to work and poor working conditions. Flooding around the building could restrict the ability to operate as workers and visitors are unable to access or leave the building. Projected increases in average temperatures, of up to 3.8 °C by the end of the century, at this site could lead to: • Increased risk of overheating to occupants. • Risk of HVAC capacity mismatch leading to reduce efficiency and premature system failure. • Faster deterioration of building elements. • Increase risk of planting failure, even with local natives.

Climate Change Pre-screening Checklist Criteria	Criteria response Yes/No	Comments If answered yes, provide further explanation
Have adaptation options been identified for any key risks? If yes, please describe design or operational measure.	Yes	Drainage design has been undertaken to allow for future rainfall under a high warming scenario SSP3-7.0. Floor level freeboard has been set at 500mm above 1% AEP (including climate change) event and 300mm bunding has been included to the car park design. This is adequate to manage the 157mm rainfall in 24 hours (SSP3-7.0, 1% AEP rainfall event). All overland flows are managed to flow away from the building. Foundations have been designed for the

		local ground conditions including groundwater heights. Other potential adaptation measures have been highlighted to the Client, based on the hazards identified but none implemented. These include: Heavy rainfall/flooding: • An Emergency Response Plan and Business Continuity Plan to plan out safety measures in an event and support on-going operations. • Increase in gutter and downpipe capacity suitable for their lifetime, 1 in 50 year rainfall events. • Planting that is resistant to damage/disease due to waterlogged ground and can support stormwater management. Overheating: • Lighter roof colour. • Greater redundancy in HVAC design. • Increase in shading to mitigate overheating risk. • Use of materials that can remain robust in elevated temperatures. • Canopy coverage in landscaping to reduce risk of heat island and lower localised temperatures.

Climate Change Pre-screening Checklist Criteria	Criteria response Yes/No	Comments If answered yes, provide further explanation
Will the project accommodate occupants who may be vulnerable to the impacts of climate extremes? (e.g. children, elderly, low mobility, seeking medical treatment). Please indicate potential groups of vulnerable occupants and which hazards they are likely exposed to.	Yes	The building is designed to be commercial offices and retail, accommodating low mobility staff and visitors within the design. The project has been designed to support accessible users which may include those with low mobility. Flooding poses the greatest risk to these building users. However, a power outage could also pose potential problems as the lift will not be operational and some uses may require further assistance to enter and exit their work floor.

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