



Investor
Group on
Climate
Change

QIC

Resilient Infrastructure

Physical Climate Risk Assessments
for Defensible Decision-Making

Published May 2026

About the Investor Group on Climate Change

We are the leading network for Australian and New Zealand investors to understand and respond to the risks and opportunities of climate change.

Our members include our countries' largest superannuation and retail funds, specialist investors, and advisory groups. They are custodians of the retirement funds and savings for more than 15.8 million Australians and millions more New Zealanders.

Our members manage almost \$5 trillion locally.

This guide is informed by feedback and contributions from members of the IGCC Real Assets Sub-Working Group. However, the content and recommendations presented are those of IGCC and do not necessarily represent the views of individual IGCC member organisations or imply their endorsement.

About QIC

We are an institutional investment manager and sovereign investor, driving resilient investment outcomes and creating value for our clients.

For over 30 years, we've partnered with clients globally, applying discipline, insight and conviction to navigate megatrends and market forces that shape the investment landscape. We manage ~\$137 billion assets under management, across five asset classes for ~125 clients.

Our founding legislation allows us to act and operate as an independent commercial entity (with an independent Board and CEO), with government ownership embedding a culture of long-term stewardship.

QIC Infrastructure manages \$41.4 billion assets under management across 21 direct infrastructure investments in five OECD countries.

Acknowledgements

This paper was written by QIC Infrastructure's Timothy Grech and IGCC's Dr Kate Simmonds. It was reviewed by IGCC's Fergus Pitt and Duncan Paterson.

Thank you to IGCC's Real Assets Sub-Working Group, who contributed to the thinking and reviewing of this guide, with particular thanks to:

Rick Walters, Aware Super

Rae Addison, AustralianSuper

Lobaba Idris and Paul Dunne, CEFC

Christopher Pritchard, Macquarie Asset Management

Margot Black, Investa

Dr Georgia Warren-Myers, JLL

Bjorn De Smedt, First Sentier

Lauren Rossiter, GHD

Stephen Catchpole, ERM Energetics

Julia Leske, ISS STOXX

In addition, thanks to Dr Ned Haughton from the University of Melbourne for his review.

Contents

Executive Summary	4
1: Introduction	6
2: Current Practice and Standards	7
3: The Need for <i>Defensible</i> Assessment	9
4: Process, Requirements, and Technical Guidance	11
4.1. Overview of Resources	12
4.2. How to Use the Resources	13
4.3. Inputs: Data and Stakeholder Engagement	14
4.4. Develop Understanding of Risks	16
4.5. Detailed Assessment of Risk	19
5: Next Steps	21



Executive Summary

This guide provides a set of resources to support investors and companies as they work to improve their assessment of physical climate risks to infrastructure assets. Infrastructure is highly exposed to physical climate risks, and failures can lead to significant financial, operational, and reputational consequences.

Current industry practices for physical climate risk assessments can be inconsistent or lacking in rigour. Key challenges include a failure to capture asset-specific vulnerabilities

or cascading risks from interdependencies. This guide addresses these gaps by defining a process for physical risk assessments that supports defensible decision-making and adaptation planning. It builds on existing standards while introducing key improvements to increase consistency, transparency, and technical robustness.

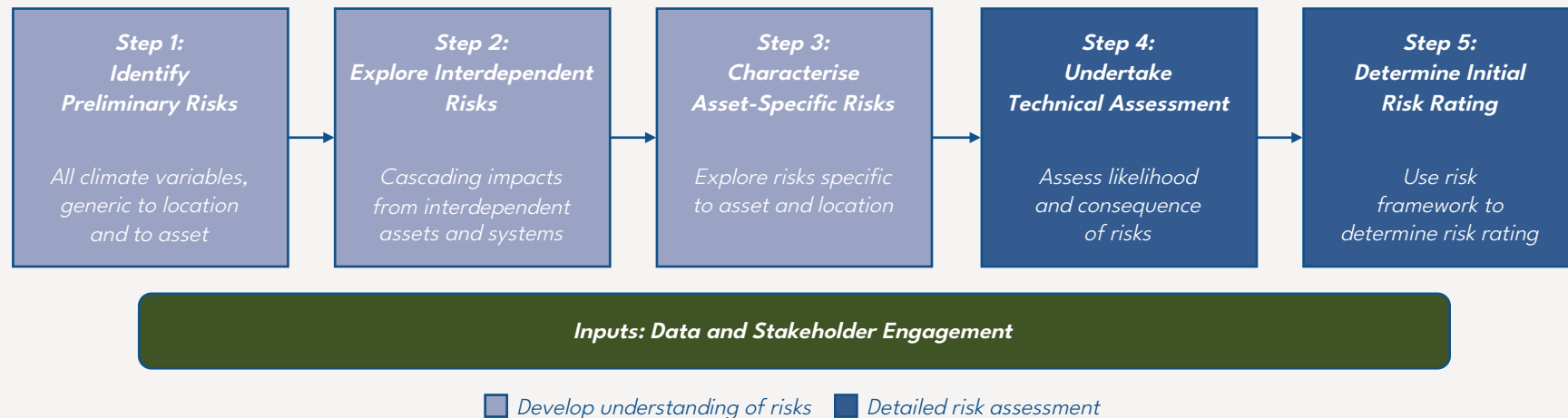
This guide includes three core resources that together support a **defensible physical climate risk assessment**.

First, the guide outlines a representative process (Figure 1), supported by technical guidance for implementation. While it is intended primarily for companies (and service providers) conducting risk assessments, investors are encouraged to actively influence companies to adopt this type of process, and to use it as a basis when engaging with companies on their assessments.

Second, the guide identifies a list of requirements that physical climate risk assessments should meet to be considered a defensible basis for decision-making. These are:

1. Use scenarios with a moderate and high level of warming to represent the range of plausible risk.
2. Demonstrate consideration of risks from all material hazards, including:
 - a) All aspects of operating an infrastructure asset.
 - b) Cascading impacts from interdependencies.
3. Detail risks to specific infrastructure assets, factoring in location and attributes.
4. Design and implement technical assessments for all material risks.
5. Adopt a climate-specific risk framework and assessment criteria and align critical thresholds to the Board's risk appetite.
6. Appraise and communicate the level of confidence in the risk ratings.

Figure 1: Process for defensible physical climate risk assessment



A representative process, including key steps, for a defensible physical risk assessment.

Companies (and service providers) should aim to meet these requirements when undertaking physical climate risk assessments. Investors should encourage and support companies to meet these requirements, and can use them to evaluate the defensibility of assessments.

Third, the guide provides an asset-specific [physical climate risk register template](#). This template supports companies in documenting assessment outputs consistently.

Together, these resources enable companies to implement a clear, consistent, and defensible process to assess physical climate risks. For investors, the resources improve comparability of assessments across assets, build confidence that risks are being adequately assessed and managed, and enhance the quality of climate-related disclosure.

While this guide focuses on risk assessment, it forms the foundation for subsequent adaptation planning, financing, and implementation. Therefore, this guide is an essential first step for investors and companies to move beyond compliance towards proactively strengthening the resilience of infrastructure assets and investment portfolios.

1: Introduction

Damage and disruption caused by climate change is accelerating, impacting communities and economies worldwide. Infrastructure assets, which are critical to delivering essential services, are particularly exposed. When these assets fail, the consequences ripple outwards: communities lose access to vital services, and investors and companies face financial, operational, legal, and reputational risks.

Investors and companies share a responsibility to ensure that infrastructure remains resilient in a changing climate. This requires proactive measures, including operational adjustments and targeted investment in adaptation. For investors to have confidence that asset value is adequately protected, these measures must be underpinned by **defensible physical climate risk assessments** that provide a credible basis for decision-making.

The primary responsibility for undertaking these risk assessments and managing asset resilience sits with the companies that operate them. However, investors have a direct

and material interest in the resilience of these assets, as it underpins long-term value and the stability of returns. Investors have oversight of climate risk management primarily through company boards, with the degree of influence shaped by the investment type and scale of ownership. High-quality, asset-level risk assessment outputs are therefore essential to effective stewardship, through supporting informed board engagement, and setting operational key performance indicators (KPIs) and other mechanisms that drive improved resilience.

This guide sets out a clear process, minimum requirements, and supporting technical guidance to improve the consistency, transparency, and credibility of physical climate risk assessments. By defining what constitutes a defensible approach in practice, the guide strengthens confidence in risk assessment outputs and supports informed decision-making. In turn, this enables real-world improvements in infrastructure resilience and safeguards long-term investor returns.

2: Current Practice and Standards

The potential impacts of climate change on infrastructure assets should be assessed through a risk-based approach. Established risk management practices form the basis for this, including the international standard ISO 31000:2018 – Risk Management.¹ These practices include the use of *likelihood* and *consequence* (see Box 1) to inform a risk rating.

Box 1: Defining *Likelihood* and *Consequence*

Likelihood is defined as the chance or probability of a climate hazard (or climate-related event) occurring. Crucially, likelihood represents the chance that the underlying climate hazard would occur and not the likelihood of the impact occurring.

Consequence is defined as the severity of the impact if the climate hazard occurs, and considers existing controls and adaptation measures which mitigate risk.

These definitions align with AS 5334:2013 – Climate change adaptation for settlements and infrastructure – A risk based approach.²

Physical climate risk is a unique type of risk with distinct complexities, challenges, and organisational needs. It is often implemented outside of the conventional risk management function. Some progress has been made to apply these practices to physical climate risk,³ namely in AS 5334:2013 and ISO 14090:2019 – Adaptation to climate change – Principles, requirements and guidelines.⁴

However, there are gaps in these standards that are highly material to the effectiveness of building real-world resilience, including insufficient guidance on:

1. The full end-to-end process linking physical climate risk assessment with the implementation of adaptation measures (which ultimately strengthen resilience).
2. Use of climate change scenarios and projections.
3. Technical activities required to inform the assessment of risk.
4. Technical activities required to explore and evaluate adaptation options.
5. Frameworks for making key decisions, including what risks require treatment and the level of resilience required.
6. Monitoring and evaluation, including how organisations should track risk ratings over time and evaluate the real-world effectiveness of an adaptation measure.

This guide addresses the gaps associated with the assessment of risk (list items 2 and 3 above). It contributes to defining an end-to-end process that links physical risk assessment to the implementation of adaptation measures (item 1). The remaining gaps are beyond the scope of this guide but may be addressed in future work.⁵

1 ISO (2018) ISO 31000:2018 – Risk Management [[link](#)].

2 Standards Australia (2013) AS 5334:2013 – Climate change adaptation for settlements and infrastructure – A risk based approach [[link](#)].

3 Alongside standards, rating schemes have been developed with additional requirements for projects/companies choosing to apply the respective schemes. These include the Infrastructure Sustainability Council's IS Rating Scheme and the Green Building Councils of Australia Green Star Rating System. However, these rating standards are not broadly applicable in the investment context.

4 ISO (2019) ISO 14090:2019 – Adaptation to climate change – Principles, requirements and guidelines [[link](#)].

5 See Section 5 for more information.

3: The Need for *Defensible* Assessment



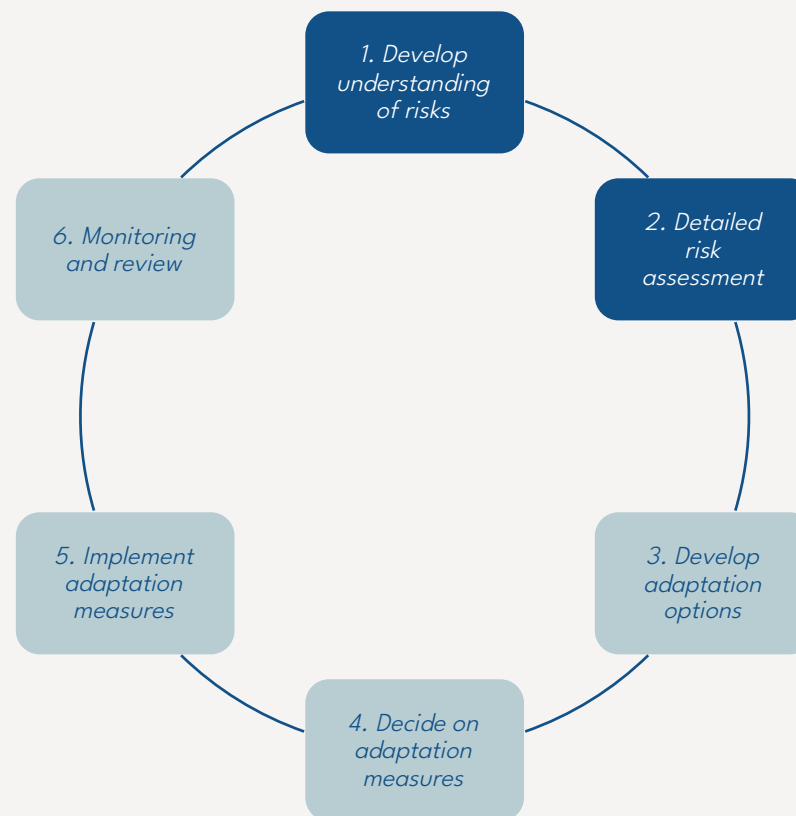
The primary objective of any company undertaking a physical climate risk assessment process should be to **strengthen the resilience of its assets to physical climate risk**. Figure 2 illustrates how understanding and assessing risks (Stages 1 and 2) enable the development and approval of adaptation measures (Stages 3 and 4), which can then be implemented (Stage 5) to improve asset resilience. These initial stages also establish the foundation for ongoing stakeholder engagement throughout the process and support monitoring and review of risks and adaptation measures (Stage 6).

Many companies in the infrastructure sector have not progressed past the first two stages due to the gaps in existing climate risk management standards and methodologies. Inadequate physical climate risk assessments undermine a company's (and its investors') confidence in the outputs of the assessment (i.e., the risk ratings). This means the outputs cannot be relied upon (or considered defensible) for decision-making.

This guide outlines the minimum process and requirements a company *should* undertake to ensure risk assessment outputs can be used as a basis for defensible decision-making, including for:

- Company decisions on adaptation measures, including optioneering, development of resilience business cases, and implementation.
- Boards discharging due oversight of the management of physical climate risk.⁶
- Building investor confidence that assets are adequately protected and strategically positioned for growth.
- Company and investor climate-related financial disclosures.⁷
- Reporting by companies and investors to regulators and government bodies.
- Collaboration with governments, regulators, and adjacent infrastructure assets to address whole-of-system⁸ and community resilience.

Figure 2: The six stages to strengthen asset resilience



These are the six stages in undertaking a defensible process to strengthen the resilience of infrastructure assets to physical climate risk. The first two stages are the focus of this guide; however, the outcomes and representative activities of the other stages are outlined in Section 5.

⁶ In Australia, the Corporations Act 2001 (Commonwealth) (section 180) imposes a duty of due care and diligence upon company directors. The Noel Hutley SC “the Hutley Opinions” [[link](#)] emphasised the relevance of managing climate change risk as part of this duty of care and diligence. In addition, oversight and eventual director level sign-off is a key requirement of mandatory climate disclosures.

⁷ The Australian Sustainability Reporting Standards climate-related disclosures (ASSB S2) have come into effect from January 2025. They specifically include the disclosure of risks and opportunities relating to physical climate risk.

⁸ IGCC (2024) Activating private investment in adaptation [[link](#)].

4: Process, Requirements, and Technical Guidance

4.1. Overview of Resources

This section outlines how to undertake a **defensible physical climate risk assessment of infrastructure assets** using:

1. A representative process that sets out the key steps for assessment, supported by technical guidance for implementation.
2. A list of requirements that assessments should meet to be considered defensible.
3. Guidance on how outputs from the process can be incorporated into the asset-specific [physical climate risk register](#).

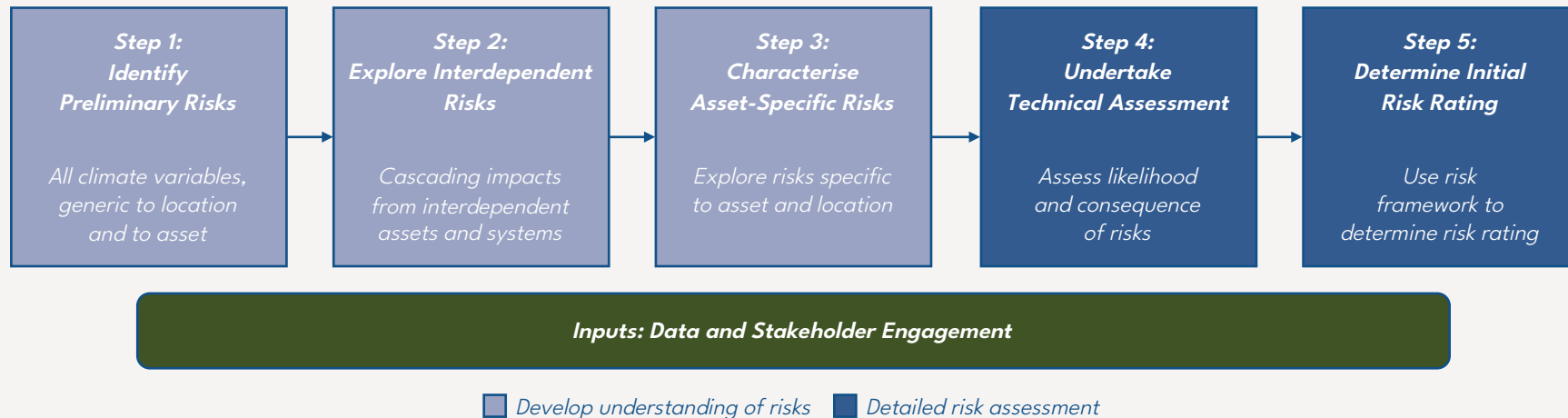
The process has two overarching stages (Figure 3). The first is to develop an understanding of risks (light blue), and the second is to undertake a detailed assessment of these risks (dark blue). Further, important inputs are required throughout the risk assessment process (dark green).

The requirements focus on six key areas to improve the defensibility of risk assessments. These are:

1. Use scenarios with a moderate and high level of warming to represent the range of plausible risk.
2. Demonstrate consideration of risks from all material hazards, including:
 - a) All aspects of operating an infrastructure asset.
 - b) Cascading impacts from interdependencies.
3. Detail risks to specific infrastructure assets, factoring in location and attributes.
4. Design and implement technical assessments for all material risks.
5. Adopt a climate-specific risk framework and assessment criteria and align critical thresholds to the Board's risk appetite.
6. Appraise and communicate the level of confidence in the risk ratings.

The process and requirements identified are not intended to be an exhaustive list of all activities a company might undertake. Rather, they emphasise the main steps and improvements required. The sequencing of steps may vary, provided that the requirements are met.

Figure 3: Process for defensible physical climate risk assessment



A representative process, including key activities and inputs, for a defensible physical risk assessment.

4.2. How to Use the Resources

Various types of organisations may seek to assess physical climate risks for an infrastructure asset. Table 1 identifies some of these organisation types and highlights the intended use and benefits of the resources. However, the resources may be useful to a broader group of stakeholders who undertake or use physical climate risk assessments of infrastructure assets.

Companies and investors should implement the resources during the asset management phase, as this is when the necessary time, capacity, and access to asset-specific information are available. The resources may also be used across the broader investment lifecycle, including during due diligence. However, available information and the depth of assessment may be constrained.

The infrastructure lifecycle should also be considered. Companies can apply the process and requirements directly to existing infrastructure assets and integrate them into planning and development of new assets. This will minimise delivery costs and optimise resilience to physical climate risks.

Table 1: Use and benefits for different organisations

Organisation Type	How to Use	Benefits
Companies that own and/or operate infrastructure assets (“companies”)	<ul style="list-style-type: none"> • Adopt defensible physical climate risk assessment process. • Seek to meet the requirements. • Use template to document key outputs from assessment process. 	<ul style="list-style-type: none"> • Provides a consistent process for assessing risks, resulting in clear internal and external communication. • Offers a simple and consistent method of demonstrating defensibility of assessments.
Investors and investment managers (“investors”)	<ul style="list-style-type: none"> • Provide guide to companies and support implementation. • Use the requirements to support engagement with companies and determine whether a physical climate risk assessment is defensible. 	<ul style="list-style-type: none"> • Ensures consistency of assessment process and outputs between companies, resulting in better information for investment decisions and disclosures. • Provides a simple and consistent method for assessing defensibility of assessments.
Investment advisors and service providers (“service providers”)	<ul style="list-style-type: none"> • Adopt defensible physical risk assessment process when undertaking work for clients. • Seek to meet relevant requirements. 	<ul style="list-style-type: none"> • Provides consistent process for assessing risk, resulting in more comparability and efficiency between clients. • Offers a simple and consistent method of demonstrating defensibility of assessments.

How to use the resources and the benefits of using the resources for different types of organisations: companies, investors, and service providers.

4.3. Inputs: Data and Stakeholder Engagement

Collecting data and engaging with stakeholders are essential inputs to the defensible risk assessment process. This section gives some guidance on data collection, which should occur iteratively throughout the process, rather than as a discrete activity at the start.

Likewise, stakeholder engagement — internal or external — should occur throughout the process to gain essential information, build understanding and trust in the assessment, and ensure the assessment outputs are useful. We do not provide specific guidance on stakeholder engagement, as this is highly contextual. However, we highlight the steps in the process where engagement is particularly important.

4.3.1. Data Collection

In this section, guidance is provided on the three primary data types needed for a physical climate risk assessment: hazard, exposure, and vulnerability.⁹ Different levels of data granularity may be appropriate at different steps. For example, less granular data may be sufficient in early steps to form preliminary risk statements. In contrast, more granular data may be required later to support technical assessments.

Hazard

Hazard refers to the possible future occurrence of natural or human-induced physical events that may adversely affect vulnerable and exposed elements. In the context of this guide, this refers to changes in climatic conditions (chronic risks) and resulting hazards (acute risks). This information is typically provided through:

- **Climate change projections**, which comprise modelled changes to climate variables.
- **Hazard data/models**, which build on climate change projections and model the frequency and intensity of hazards influenced by one or more climate variables, as well as other inputs (e.g., topography).¹⁰

Exposure

Exposure refers to the inventory of elements in an area where hazard events may occur. This includes the geographical location of an infrastructure asset and its critical components.

Vulnerability

Vulnerability refers to the propensity of exposed elements to suffer adverse effects when impacted by hazard events. In the context of infrastructure assets, this requires four main types of information:

- Design information specific to individual assets, including the structure, components, materials, and engineering performance.
- Condition information, including outcomes of condition assessments to inform the remaining useful life.
- Performance information, including the asset's performance during past weather events, operational performance, and maintenance data.
- Sensitivities to material impacts, such as asset damage, losses in revenue, customer impacts, and interdependency impacts (e.g., services, suppliers, customers).

Requirement 1: Use scenarios with a moderate and high level of warming to represent the range of plausible risk.

⁹ All definitions are from IPCC (2012) Determinants of risk: Exposure and vulnerability [[link](#)].

¹⁰ Hazard models are typically developed by service providers. Their coverage, resolution, and quality vary geographically and by hazard type. The relationship between climate variables and hazards can vary in complexity. In some cases, a climate variable can directly influence the hazard (e.g. extreme heat or atmospheric corrosion). In others, several climate variables may interact with other factors to influence the hazard (e.g., heat, rainfall, and vegetation type all influence bushfire hazard).

Box 2: Choosing Climate Scenarios, Projections, and Hazard Data

Using credible data is critical to undertaking a defensible assessment of physical climate risk. Therefore, the choice of climate scenarios, projections, and hazard data should be carefully considered.

Climate scenarios should be:

- **Consistent:** Reference the Intergovernmental Panel on Climate Change's (IPCC) five Shared Socio-Economic Pathways (SSPs) when selecting scenarios for physical risk. Using SSPs ensures alignment with internationally recognised climate science and provides a consistent basis for scenario selection.
- **Relevant:** Select SSP scenarios which focus on both moderate (SSP2-4.5) and high warming scenarios (SSP3-7.0 or SSP5-8.5):
 - The benefits of using a lower warming scenario (SSP1-2.6) are limited for assessing physical climate risk impacts.
 - Using both moderate and high warming scenarios is strongly recommended to explore:
 - The range of consequences under different warming scenarios.
 - The sensitivity of consequences to shifts in the warming scenario.
 - Assessing both moderate and high scenarios does not lock in these scenarios for full mitigation. Instead, it provides a broader evidence base to inform credible adaptation development and decision-making.
- **Aligned:** The use of scenarios, projections, and hazard data should align with the infrastructure asset and its key components, the risk profile of the service provided, and the Board's risk appetite. This requires two primary actions:
 - **Select scenarios and inputs that match the Board's risk appetite:** Risk appetite considerations may influence scenario selection. This may include choosing different statistical approaches when selecting projections (e.g., best-case, consensus, worst-case),¹¹ and deciding which scenarios are carried through to adaptation planning. For example, an electricity distribution company may have a very low appetite for service disruption due to financial, reputational, and health impacts. Therefore, using both consensus and worst-case projection information across moderate and high warming scenarios may be appropriate.

- **Adopt appropriate time horizons:** Time horizons should be chosen to reflect the design or actual lifespan of the asset and its critical components. For example, cooling equipment with a 30-year lifespan may use a 2060 assessment horizon. However, it should be noted that assets' actual life often exceeds designed life, requiring the consideration of longer time horizons.

Climate projections should be:

- **Reputable and recent:** Source projections based on the latest IPCC assessment cycle, currently the Sixth Assessment Report (AR6).
- **High resolution:** Use dynamical downscaled¹² projections from government-developed, high-resolution regional climate models (RCMs), where available and appropriate.¹³

Hazard data should be:

- **Credible and transparent:** Hazard data may be provided by governments (e.g., Australian Climate Service Data Explorer) or private service providers. Transparency and quality vary, so users should consider¹⁴ whether the:
 - Methodology used to create the data is adequately described and is consistent with the most recent science.
 - Data has been tested and validated, including against open-source information and/or past events.
 - Data uses climate change projections that align with IPCC AR6 and, preferably, uses dynamical downscaled projections developed from government sources.
 - Data is sufficiently consistent, accurate, and complete.
 - Data limitations are clearly understood, including missing exposure or vulnerability factors, key assumptions and estimates, and data sensitivity to methodological choices.
- **Quantitative, where appropriate:** To use hazard data in a quantitative risk assessment, the hazard data must also be quantitative. For example, hazard data that provides a flood depth in metres at a given frequency, rather than a qualitative risk rating (e.g., low). However, for hazards where changes due to climate change are less certain, qualitative data (and therefore, qualitative technical assessment) may be more appropriate. In such cases, transparency on the rationale for using qualitative methods is essential.

¹¹ For example, Climate Change in Australia (2025) Australian Climate Futures [\[link\]](#).

¹² See Climate Change in Australia (2020) Downscaling [\[link\]](#) for more information on dynamical downscaling.

¹³ NESP (2025) Navigating climate portals [\[link\]](#) provides a useful overview of climate projections available in Australia.

¹⁴ Note: These considerations are based on APRA's GPS 116 standard [\[link\]](#), which includes requirements for insurers using catastrophe models.

4.4. Develop Understanding of Risks

Step 1: Identify Preliminary Risks

The first step is to develop qualitative preliminary risk statements that reflect typical hazard impacts on an asset type. This can be done using a matrix (see Figure 4) to:

- Identify which **hazards** (e.g., extreme rainfall) are relevant to each asset type (e.g., substations).
- Determine the typical **impact** on the asset (e.g., flooding of substations).
- Form a preliminary risk statement about the **consequence** of the impact (e.g., decreased service availability of transmission infrastructure or increased operating expenditure for repairs).

These risk matrices act as a starting template for later refinement, where the risks will be contextualised for specific assets and locations (Step 3).

This step may be done as part of a preliminary risk assessment. This is a common offering by service providers or internal teams, but it is critical to:

- Ensure the list of preliminary risks is comprehensive and includes all hazards, impacts, and asset types so that risks are not missed — potentially compromising risk assessment efficacy.
- Understand the limitations of the preliminary risk assessment, including its subjective nature and lack of consideration for the specifics of a particular asset or its location.

Output: Preliminary risk statements for each asset type and component (direct risks only).

Requirement 2a: Demonstrate consideration of risks from all material hazards, including all aspects of operating an infrastructure asset.

Figure 4: Matrix-style preliminary risk statements

Hazard	Impact on Asset Types and Components					Consequence Preliminary risk statement
	Turbine	Substations	Transmission	Access	People	
Extreme heat						
Extreme rainfall		<i>e.g., flooding of a substation</i>				<i>e.g., decreased service availability of transmission infrastructure</i>
Extreme wind						
Bushfire						
Sea level rise and storm surge						
Atmospheric and ocean-induced corrosion						
Change in wind patterns						
Change in solar irradiation						

Example of matrix-style preliminary risk statements for each asset type.

Step 2: Explore Cascading Impact Risks

Alongside direct risks, it is critical to understand interdependencies with other systems essential to the operation, maintenance, service delivery, and emergency response of the asset. Physical climate impacts affecting these interdependent systems may lead to cascading impacts (*cascading impact risks*). Although companies vary in their ability to influence these risks (as they fall outside of direct operational control), they are still highly relevant to the overall resilience of the infrastructure asset.

For these risks, critical information is often held by other stakeholders (i.e., the companies operating the assets within the supply chain). Therefore, it is vital to engage with these stakeholders to build an understanding of the relevant risks and the potential for collaborative adaptation options.

While approaches will differ depending on the asset, hazard, and dependency type, a two-step approach may be helpful:

1. Map the asset's value chain (including supply chain) to understand key nodes of interdependencies.

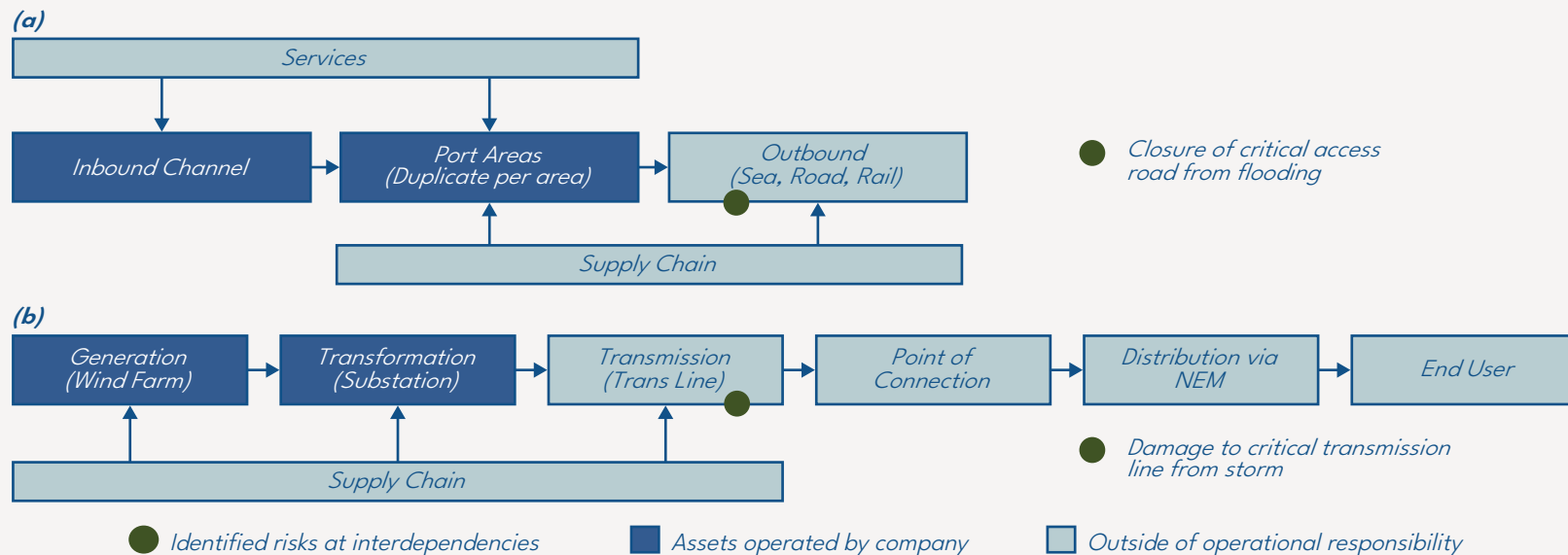
2. Consider the types of risk that may affect each node of the value chain and identify how they could cascade back to the primary asset.

Value chain maps will differ significantly across infrastructure types. Figure 5 shows two representative examples where the company's value chain is mapped, and a material impact is identified. These impacts can then be further explored (as needed) and formed into preliminary risk statements using the same matrix approach shown in Figure 4. However, instead of asset types and components, the matrix should include key nodes of the asset's supply and value chain. These may include electricity, water, public access, and telecommunications.

Output: Preliminary risk statements for key nodes of an asset's supply and value chain (interdependent risks).

Requirement 2b: Demonstrate consideration of risks from all material hazards, including cascading impacts from interdependencies.

Figure 5: Cascading impact risks for (a) landlord port and (b) energy generation



Representative example of mapping physical climate risks within the value chain of two infrastructure assets: (a) landlord port and (b) energy generation. Examples of cascading impacts include (a) flooding of a critical access road that prevents the movement of freight to and from the port and (b) storm damage to transmission towers that prevent the wind farm from exporting energy to the National Electricity Market (NEM).

Step 3: Characterise Asset-Specific Risks

The next step is to refine and apply these risks to the specific infrastructure assets, to support the development of a physical climate risk register. This work should include:

- Affirming the preliminary risks are relevant to the specific infrastructure asset, noting some risks may be removed where there is no exposure.
- Reviewing the impact of each risk, considering asset-specific vulnerability information.
- Developing formal risk narratives, which form the first part of an asset-specific physical climate risk register.

Output: Asset-specific risk statements for each asset type, component, and value/supply chain node (direct and interdependent risks). This should be documented in an asset-specific physical climate risk register. In the template provided, the outputs should be included in columns C–L.

Requirement 3: Detail risks to specific infrastructure assets, factoring in location and attributes.

Box 3: Materiality

The concept of materiality is a useful tool for prioritisation, and organisations may apply it differently. However, during the risk assessment stages outlined in this guide, risks should not be excluded on the grounds of immateriality. Instead, materiality should inform the depth of technical assessment. If a risk is assessed as immaterial, the decision should be justified and documented and should inform the risk rating. This ensures transparency and supports future reviews, particularly where new data, climate science, or operational context may change a risk's materiality.

4.5. Detailed Assessment of Risk

Step 4: Undertake Technical Assessment

Asset-specific risks should then be assessed in alignment with the general risk-based approach outlined in ISO 31000:2018 and AS 5334:2013. However, as discussed in Section 2, these standards typically contain ambiguities that limit the defensibility and quality of output.

To drive a defensible assessment, technical assessments should directly inform the risk assessment. These assessments provide a transparent and objective evidence base, which is crucial to strengthening real-world resilience. Co-development of this step with engineering, design, operations, maintenance, and risk management functions is critical to achieving a defensible assessment.

The appropriate methodology for technical assessments will vary depending on the type of asset and component impacted, as well as the hazard driving the risk. A practical approach should consider:

- **Existing design and engineering methodologies:** The existing methodologies used in the design, construction, and operation of the asset as relevant to the risk. This typically includes design and engineering-driven technical assessments, which measure the sensitivity of an impact to an asset.
- **Available hazard models:** The ability to simulate how climate change will influence a hazard varies, and data availability can limit the type or complexity of technical assessment that can be done. The assessment methodology should match the data quality, and it may be impractical to do a detailed assessment where data confidence is low (e.g., impact of climate change on wind patterns in Australia).
- **Available resource:** Technical assessments are best done where integrated with internal teams and operational processes. However, companies without the available internal resources may need to engage service providers.
- **Cost:** While costs should be managed pragmatically, these should not prevent assessment. Instead, the assessment level should be proportionate to the design and engineering methodology and the risk materiality for the asset (i.e., potential financial losses).

Two types of assessments are typically undertaken:¹⁵

- **Quantitative:** A quantitative approach is preferred when impacts can be meaningfully modelled, as it gives an objective basis for determining consequence. Where possible, the assessment should draw on technical analysis or modelling. The specific analysis or modelling type will vary depending on the risk, the asset the risk relates to, and, in some cases, the industry. For physical assets, this is commonly done as an extension to existing engineering and design modelling methodologies.
- **Qualitative:** Some risks cannot be meaningfully quantified due to limitations in data, science, or hazard predictability. In such cases, a qualitative approach can be used to form an objective position. Companies should give a short explanation of why they have used a qualitative method and describe how the chosen approach was selected. While the appropriate format will vary, a common qualitative method is a multi-criteria analysis, which can be adjusted in complexity. This involves establishing relevant evaluation criteria, providing descriptive evaluation of the criteria against the time horizon and trend in projections, and logically aggregating findings to inform the risk rating.

Output: Technical assessments, which directly inform the assessment of consequence for all material risks. In the physical climate risk register template, the outputs of this step should be included in columns O-S and U-Y.

Requirement 4: Design and implement technical assessments for all material risks.

¹⁵ However, new risk assessment methodologies are emerging that blend qualitative and quantitative information and may be appropriate in some circumstances. See, e.g., Fiedler, T et al (2025) Storylines: A science-based method for assessing and measuring future physical climate-related financial risk [[link](#)].

Step 5: Determine Initial Risk Rating

Once the consequence has been determined, the output can be converted into a risk rating. This process involves overlaying assessment outcomes with the consequence and likelihood criteria within a risk assessment framework (or matrix). AS 5334:2013 provides criteria; however, Climate Change in Australia's Electricity Sector Climate Information Project has since produced improved criteria¹⁶ that could be built on for broader infrastructure asset types.

The choice of risk assessment framework, including the consequence and likelihood categories, criteria, and thresholds, should align with or be informed by the Board's risk appetite (similarly to the recommendations in IGCC's Investor Expectations of Companies on Physical Risk Management and Resilience¹⁷ for listed companies).

Output: Risk rating and the level of confidence for all material risks, which can then be added to the asset-specific risk register. In the template, risk ratings are recorded in columns T and Z, and levels of confidence are recorded in columns R–S and AA–AB.

Requirement 5: Adopt a climate-specific framework and assessment criteria and align critical thresholds to the Board's risk appetite.

Requirement 6: Appraise and communicate the level of confidence in the risk ratings.

Box 4: Level of Confidence in Assessing Risk

The level of confidence for each risk rating is a critical component of a defensible assessment. Confidence can vary due to uncertainty in climate science, availability of relevant climate projections and hazard models, robustness of technical assessment methodology, and the availability of specialist resourcing. While there are various methods for determining levels of confidence, the approach used and the reason for selection should be clearly documented.

It is crucial to appraise the level of confidence for each risk rating and note all material limitations. This can be captured within the completed risk register and is relevant for:

- Developing adaptation measures, including preferencing “soft” adaptation options over “hard” where there are technical limitations in designing hard options.¹⁸
- Prioritising and choosing appropriate adaptation measures, exercising caution in investing in measures where the level of confidence may be low.
- Identifying where further technical assessment is required, including opportunities to engage with industry stakeholders or research organisations.
- Planning review cycles. For example, assessments with low confidence may be prioritised for earlier review than assessments with high confidence, if there are updates to science or technical advances.

¹⁶ Climate Change in Australia Electricity Sector Climate Information Project [[link](#)]. Note: click on “defining consequence” and “defining likelihood” dropdown menus.

¹⁷ IGCC (2025) Beyond risk to building resilience: Investor expectations of companies on physical risk management and resilience [[link](#)].

¹⁸ For example, Sovacool BK (2011) Hard and soft paths for climate change adaptation [[link](#)].

5: Next Steps

As outlined in Section 3, risk assessment is only the first two stages in the process of strengthening the climate resilience of an infrastructure asset. Detailed guidance on the next stages falls outside this document's scope, but may feature in future publications. However, an overview of these stages, including the risk assessment stages, is provided in Table 2.

Table 2: Overview of defensible process

Stage	Description and Key Activities
1: Develop understanding of risks	<p>Understand how physical climate risks can impact an infrastructure asset by linking climate variables and hazards to impacts on the asset's components, culminating in risk narratives that can be assessed. This includes activities to:</p> <ul style="list-style-type: none"> • Source appropriate climate science and projections, including selecting climate scenarios. • Understand vulnerability, including collecting asset-specific design, construction, and operational details. • Overlay exposure to understand the asset-specific impacts. • Draft clear risk narratives, defining the specific consequence to assess.
2: Detailed risk assessment	<p>Undertake objective, technical assessments to inform the consequence of risks and produce an initial risk rating. This includes activities to:</p> <ul style="list-style-type: none"> • Identify technical leads and design the best available but practical assessment methodology (typically involving design and engineering, operations, and maintenance functions). • Determine the risk matrix to use in the assessment, including refining consequence categories and trigger thresholds in line with the infrastructure asset's and Board's risk profile. • Undertake the technical assessment and document findings. • Collate the outcome of the technical assessments into a live physical climate risk register.
3: Develop adaptation options	<p>Explore adaptation options available to treat risks, including continuing technical assessments to design the adaptation options, justify their efficacy, and inform the updated risk rating (residual risk after treatment). This includes activities to:</p> <ul style="list-style-type: none"> • Identify feasible adaptation options, including across hard adaptation measures (physical infrastructure changes) and soft adaptation measures (changes in operation, maintenance, or use of infrastructure, nature-based solutions). • Design and undertake technical assessments to objectively determine option efficacy. • Identify preferred adaptation measures, noting this may include forming an adaptation pathway involving numerous measures across time. • Undertake supporting analysis to show the feasibility of preferred options, including costing, developing a resilience investment case to compare benefits, and any operational or stakeholder requirements.
4: Decide on adaptation measures	<p>Run a process with leadership to decide on adaptation measures and facilitate their implementation. In practice, the first half of this stage is iterative with developing adaptation options (Stage 3), but they are separated for clarity. This includes activities to:</p> <ul style="list-style-type: none"> • Determine the risks needing treatment (iteratively with optioneering). • Decide on the designed resilience level of an adaptation measure (iteratively with optioneering). • Explore adaptation pathways, including combining and/or sequencing measures over time (iteratively with optioneering). • Develop a defensible decision-making approach and implement it for adaptation options. • Engage with decision-makers and gain endorsement for adaptation options. • Facilitate implementation, including in establishing the financing and delivery approach.

Stage	Description and Key Activities
5: Implement adaptation measures	<p>Deliver the approved adaptation measures to enhance the resilience of the infrastructure component to the risk. This includes activities to:</p> <ul style="list-style-type: none"> • Obtain financing, including the internal budget or external funding. • Secure a delivery team, including from internal teams, specialist subcontractors, or tender for new services. • Delivery of the adaptation measures through to operationalisation.
6: Monitoring and review	<p>Monitor implemented adaptation measures to ensure they effectively mitigate the risk and make refinements. Separately, periodically review the live physical climate risk register for additions, updates, or enhancements to technical assessments. This includes activities to:</p> <ul style="list-style-type: none"> • Monitor adaptation performance, noting that where a hazard has not taken place, it can be approximated. • Review the risk register for additions; this could include undertaking the broader process for a new operational asset or including risks and/or component impacts previously not covered. • Review the risk register to ensure that risk ratings, adaptation measures, and residual risks are current (including increasing a residual risk where an adaptation measure may be less effective than indicated). • Consider updates in climate science (including complex projections with lower confidence, like wind patterns) or methodological advancements, and consider if any technical assessments should be enhanced. This should be actively monitored for material risks with lower confidence.

Overview of a defensible process of strengthening the climate resilience of an infrastructure asset.

This guide is intended to be a practical resource for companies, investors, and service providers assessing physical climate risks to infrastructure assets. As industry practice, data availability, and climate science evolves, best practice may also change over time. IGCC welcomes feedback on this guide and is particularly interested in understanding

how it is applied in practice, including through case studies and real-world examples. Stakeholders interested in contributing feedback, sharing lessons learned, or participating in future phases of this work are encouraged to get in touch.



Investor Group on Climate Change

Contact

+61 2 8974 1160

Email

Website

Linkedin

Disclaimer and Copyright

This information is provided for general purposes only and must not be construed to imply any recommendation or opinion about any financial product or service. The information provided is given in good faith and is believed to be accurate at the time of compilation. Neither IGCC or AIGCC accepts liability of any kind to any person who relies on this information. Neither IGCC, its' directors, employees or contractors make any representation or warranty as to the accuracy, reliability, timeliness or completeness of the information. To the extent permissible by law, IGCC and its' directors, employees

and contractors disclaim all liability for any error, omission, loss or damage (whether direct, indirect, consequential or otherwise) arising out of or in connection with the use of this information. IGCC is a founding partner of Climate Action 100+. Climate Action 100+ does not require or seek collective decision-making or action with respect to acquiring, holding, disposing and/or voting of securities. Signatories are independent fiduciaries responsible for their own investment and voting decisions
© 2026 Investor Group on Climate Change (ABN 15 519 534 459).