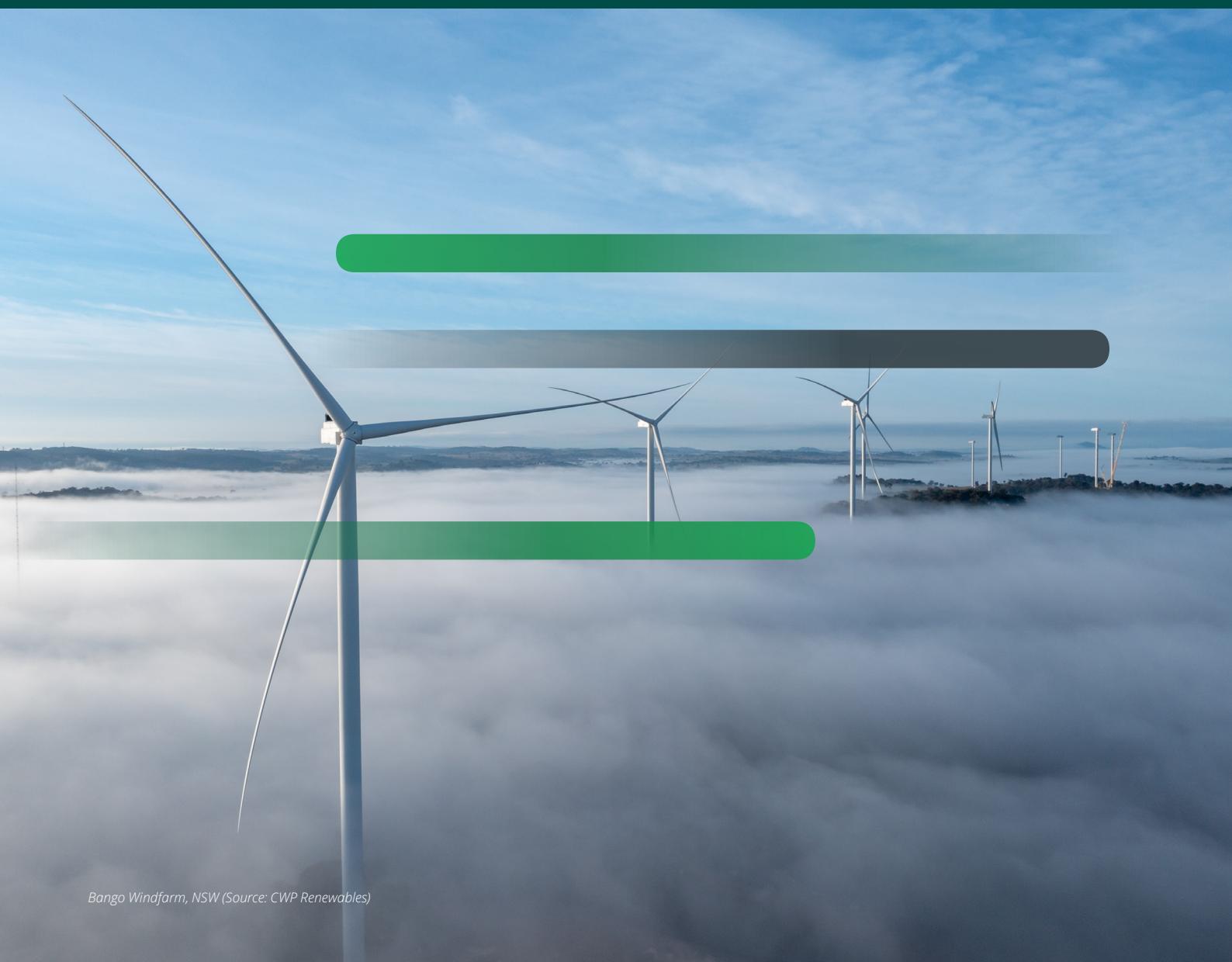


Climate Change Disclosure FY22



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—Reporting suite—

FY22 Climate Change Disclosure¹

—(this report)

Our response to the Task Force on Climate-related Financial Disclosures' (TCFD) recommendations.

FY22 Corporate Report²

The holistic performance of Transurban in FY22 including our Financial Statements and Sustainability Supplement.

FY22 Results Presentation

Management presentation of financial and non-financial results, including non-statutory analysis.

FY22 Sustainability Data¹

Our progress against the UN Sustainable Development Goals and other sustainability performance data.

Corporate Governance Statement

Statement made in accordance with the ASX Corporate Governance Council's Corporate Governance Principles and Recommendations (4th Edition).

Tax Transparency Report

Overview of our corporate structure, approach to tax and tax position for FY21—available late August 2022.

Modern Slavery Statement

Overview of how we identify, manage and mitigate the specific risks of modern slavery in our operations and supply—available late 2022.

 All available on our website
transurban.com

Acknowledgement of Country

Transurban acknowledges the Traditional Owners of the lands across Australia—in particular where we own and operate toll roads—and we pay respect to Elders past, present and emerging.

As caretakers and custodians of transportation in urban communities we have a deep respect for Indigenous communities and culture and seek to celebrate pride in Country through engagement with, and providing opportunities for, Aboriginal and Torres Strait Islander peoples. We also celebrate connection to Country through artwork and design elements in our infrastructure.

To achieve our purpose—to strengthen communities through transport—we will continue to foster positive and sustainable relationships with all communities, while progressing our efforts to contribute to Australia's reconciliation journey.

¹ Previously incorporated in our Sustainability Supplement

² We have integrated some of our Sustainability Supplement into our FY22 Corporate Report. This approach provides additional information on our non-financial performance (including environmental, social and governance performance) and progress in achieving our Sustainability Strategy

Executive summary

Forward looking statement disclaimer

This Disclosure contains forward looking statements, including, but not limited to plans, strategies and objectives of management; assumed long-term scenarios; potential global responses to climate change; regulatory and policy developments; the development of certain technologies; the potential effect of possible future events on Transurban's assets and performance and internal management estimates and assessments of traffic expectations and market outlook.

Forward looking statements may be identified by the use of terminology, including, but not limited to, 'anticipate', 'expect', 'forecast', 'potential', 'target', 'intend', 'will', 'outlook', 'aim', 'project', 'see', 'estimate', 'plan', 'objective', 'believe', 'may', 'should', 'would', 'continue' or similar expressions.

These statements discuss future expectations concerning the results of asset and/or financial conditions, or provide other forward looking information. In particular, such statements may include, but are not limited to, statements that relate to the purpose, goals, targets, plans and objectives of Transurban, assumptions made in respect to potential weather and other environmental transition scenarios, as well as statements about how we run our business, including how we engage with our stakeholders.

The forward looking statements in this Disclosure are based on the information available as at the date of this Disclosure and/or the date of Transurban's planning processes or scenario analysis processes.

There are inherent limitations with scenario analysis and it is difficult to predict which, if any, of the scenarios might eventuate.

Scenarios do not constitute definitive outcomes for Transurban. Scenario analysis relies on assumptions that may or may not be, or prove to be, correct and may or may not eventuate, and scenarios may be impacted by additional factors to the assumptions (including regulatory or other governmental changes, obligations or requirements) disclosed. Forward-looking statements are not guarantees of future performance and involve known and unknown risks, uncertainties and other factors, many of which are beyond the control of Transurban, its directors, officers, employees, agents and advisors that may cause actual results to differ materially from those expressed or implied in such statements. Transurban strongly cautions against reliance on any forward looking statements.

Except as required by applicable regulations or by law, Transurban does not undertake any obligation to publicly update or review any forward looking statements, whether as a result of new information or future events. Forward looking statements speak only as of the date of this Disclosure or the date planning process assumptions or scenario analysis assumptions were adopted, as relevant. Past performance cannot be relied on as a guide to future performance.

The views expressed in this Disclosure contain information that has been derived from publicly available sources that have not been independently verified. No representation or warranty is made as to the accuracy, completeness or reliability of the information. This Disclosure should not be relied upon as a recommendation or forecast by Transurban.

The significant and widespread flooding in South-East Queensland and New South Wales in February and March 2022 underscores the importance of robust and comprehensive climate change management for organisations like ours.

While many communities suffered major impacts, and there were subsequent broader economic effects, our infrastructure demonstrated resilience with all our road assets remaining open during this period.

FY22 has seen us advance the implementation of our Climate Change Framework with significant progress achieved in our two priority areas, namely: the transition to net zero¹ and resilient infrastructure and operations. We have entered into renewable energy agreements across all Australian markets. In FY22, 56% of our electricity needs were met through renewable energy with our renewable electricity position increasing to 66% by the end of the period. Our understanding of physical climate change risks evolved as we reflected on the flooding events and conducted a desktop emergency management exercise focused on an extreme weather event for Sydney's Hills M2

Motorway. This has moved us closer to being able to estimate potential financial impacts and improved our confidence in the likely success of planned and proposed adaptation measures. We acknowledge that there may be potential material financial risks in the future associated with climate change. At this stage, we have identified potential climate-related material impacts for the business and plan to quantify the potential financial impacts into FY23 and beyond. Our climate-related risk procedures and supply chain engagement also improved over FY22.

Our Climate Change Risk and Adaptation Guideline standardises the approach to preparing asset-specific Climate Risk and Adaptation Management Plans (CRAMPs), ensuring consistency across markets and enhancing efficiency. We prepared CRAMPs for two Queensland assets – a tunnel and an open road. We chose Queensland assets as a priority as this market has higher overall levels of climate-related risks compared to other markets where we operate. The experience of preparing the CRAMPs has flagged the importance of understanding the resilience of adjacent road networks and feeders into our assets. This is a clear area of focus for us over the coming years.

Through the CDP supplier engagement process, we surveyed our major suppliers (top 50 suppliers by spend, excluding those engaged for major projects) this year to better understand their progress in transitioning to a low carbon economy and the climate-related risks they face by geographic location. A high proportion,

71%, of responding suppliers have active Greenhouse Gas (GHG) emission reduction targets, with most either having or committed to setting science-based GHG emission reduction targets. Some appear to understand the key transition and physical risks for their operations. Examples of transition risks cited included carbon pricing (Japan) and changes to environmental regulation (Japan and Europe). Physical risks identified included extreme weather events (most geographies), rising temperatures (Japan) and bushfires (Australia). We will continue to work with our supply chain to evolve our appreciation of climate-related risks, their management approaches and impact on our operations and projects.

Five case studies with detailed information about how we are responding to transition and physical risks are provided in the Disclosure. They cover operational climate risk assessments for two Queensland assets, workshops on extreme weather events, an emergency management exercise on the Hills M2 Motorway, climate-related risks in our supply chain and how climate change has been considered in the design and construction of WestConnex's M4-M5 Link Tunnels in Sydney.

Much remains to be done. However, we are confident our Climate Change Framework remains fit for purpose – as evidenced by this year's metrics and target progress - and positions us well to respond to climate-related threats and opportunities.



¹ "Setting corporate net-zero targets aligned with meeting societal climate goals means (1) achieving a scale of value chain emissions reductions consistent with the depth of abatement at the point of reaching global net-zero in 1.5°C pathways and (2) neutralizing the impact of any residual emissions by permanently removing an equivalent volume of CO2." (SBTi Corporate Net-Zero Standard, 2021)

Section 1: Introduction

This Climate Change Disclosure is structured around the four categories of the Taskforce on Climate-related Financial Disclosures (TCFD): governance, strategy, risk management, and metrics and targets. We have continued to address all 11 of the TCFD's recommendations and have outlined the next steps we will be taking through to FY25 and beyond. A summary of how we have addressed the recommendations is outlined in [Table 1](#) on the following page.

We considered the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report and the TCFD's revised October 2021 guidelines when preparing this Disclosure, and our associated response to the revised TCFD recommendations, and more broadly in relation to our climate change program. We will also consider the potential impacts of the proposed International Sustainability Standards Board's (ISSB) first two standards for future Disclosures. KPMG have assured [Table 1](#) and [Table 4](#) of this Disclosure, to provide confidence in the veracity of key content.

Our Climate Change Framework (Figure 1 below) applies to our Australian and North American operations and responds to our strategic climate-related risk themes including four strategic climate-related threats and two strategic climate-related opportunities. We continue to evolve our understanding of the ramifications arising from climate change, with additional information on our strategic response, and improved management of climate-related risks (threats and opportunities) included in this year's Disclosure.

Figure 1: Climate Change Strategic Risk Themes & Framework

Climate Change Strategic Risk Themes

Threats

Threat 1

Unexpected changes to stakeholder expectations, government policies and regulations in relation to climate change create an unfavourable operating environment, impacting our reputation and financial performance

Threat 2

Increased incidence of severe weather events and average temperature affects lifecycle planning, disrupts operations, and increases operating costs

Threat 3

Macroeconomic and/or land use changes caused by government policies and regulations, and severe weather events, alter city travel patterns and toll road use impacting traffic models and revenue

Threat 4

Access to and use of our roads and tunnels are impacted during extreme weather events and in periods of extended rain or heat

Opportunities

Opportunity 1

Showcase our leadership in climate risk management to open new market opportunities, strengthen relationships with existing government partners, and capitalise on innovation

Opportunity 2

Take proactive steps to reduce Scope 1, 2 and 3 greenhouse gas emissions and customer emissions, and transition to net zero

Climate Change Framework

Transition to Net Zero

Energy	Low-carbon supply chain	Customer emissions	Roadside regeneration
Energy efficiency upgrades	Low-carbon materials	Customer engagement on fuel and emissions reduction	Improve vegetation and biodiversity within our alignments
Onsite renewables Renewable energy agreements	Circular economy Partnerships and engagement	Support the uptake of zero-emission vehicles	Green infrastructure

Resilient infrastructure and operations

Climate risk integration	Asset and business adaptation	TCFD alignment
Embed relevant climate projections and associated risks (threats and opportunities) within processes and systems	Scenario analysis Asset-specific Climate Risk and Adaptation Management Plans including adaptation pathways	Climate risk impact assessments Integration with financial systems, processes and reporting
Support the uptake of zero-emission vehicles	Green infrastructure	Ongoing review, monitoring and reporting
Improve vegetation and biodiversity within our alignments	Training and capacity building	Internal Climate Change Governance Committee provide additional oversight and guidance on business-wide implementation of the Framework

Governance

Climate-related risk oversight by the Transurban Board's ARC
Twice-yearly updates provided to the ARC, Transurban Board and subsidiary Boards on climate-related aspects

Internal Climate Change Governance Committee provide additional oversight and guidance on business-wide implementation of the Framework

Table 1: Summary of how we have addressed the TCFD recommendations

Governance	Recommendations addressed	FY22 summary	Next steps in the short-term (FY23-FY25)	Where this is addressed in our Disclosure
Strategy				
Risk Management				
Metrics and Targets				

Section 2: Governance

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2.1 Board oversight of climate change

Transurban's Enterprise Risk Management (ERM) Framework guides the identification of climate-related threats and opportunities, which are overseen by the Board of Directors through the ARC. The ERM Framework outlines the methodology to identify, assess, and govern material physical and transition risk, and ensure the appropriate escalation for decision-making and proactive management where required.

The ARC is updated twice-yearly through standard business and operational risk reporting on climate-related risks, areas of progress, emerging trends, and updates on climate-related issues. In FY22, updates were provided on the IPCC's Sixth Assessment Report findings and progress against the Climate Change Framework. This Disclosure is reviewed by the Board of Directors through the annual corporate reporting process, as per our previous Disclosures reported in accordance with the TCFD recommendations since their release in 2017. In March 2022 we held a Strategy Day for Transurban's Board, and in May 2022 we held Investor Day, both of which considered the organisation's transition to net zero and overall strategic direction.

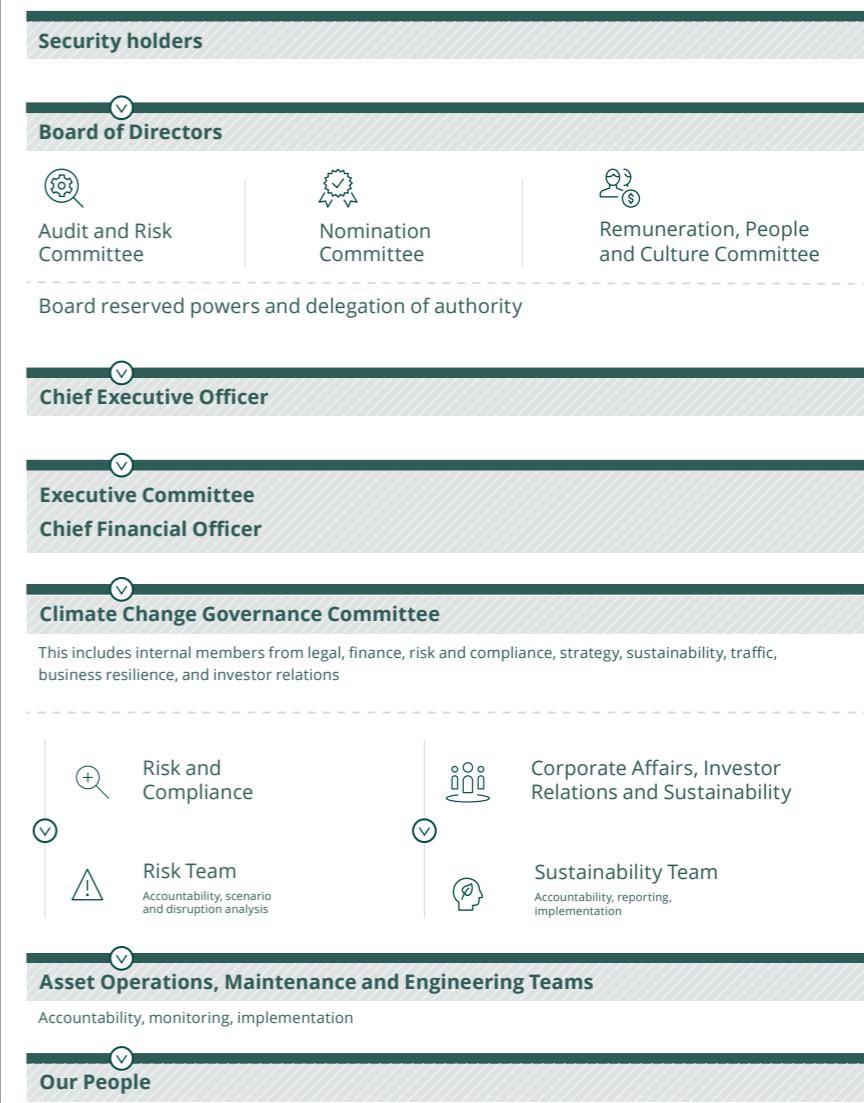
2.2 Business governance of climate change

The broad theme of climate change is considered a strategic driver of our business risks, and responsibility for climate-related risks applies to all areas of our business. The strategic response and overall direction are managed between the Sustainability and Risk teams, with additional oversight by the General Manager of Risk and Compliance, the General Manager of Corporate Affairs and Investor Relations, and the Chief Financial Officer (CFO). Asset-specific CRAMPs are developed for individual asset, climate-related risks (threats and opportunities) and the associated adaptation pathways are managed by key stakeholders involved in the operations and maintenance of the asset. Figure 2 provides an outline of our business governance structure for climate change.

Transurban's cross-disciplinary Climate Change Governance Committee provides additional internal oversight of climate-related initiatives, management priorities, emerging industry trends, and reporting on a quarterly basis. Dedicated resources are allocated to manage climate change across the organisation, including external specialist assistance.

There are a range of formal and informal communication channels used to share progress and understand the views of our investors. In FY22, Transurban's 1H22 Results Investor presentation and Investor Day presented a range of related topics including future mobility trends focused on low or zero emission vehicles (ZEVs) and our ESG progress more broadly.

Figure 2: Climate Change Governance Structure



Section 3: Strategy

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3.1 Our strategic response to climate change

Transurban continues to evolve and mature our response to climate change, and manage the associated impacts across our operations, organisational strategy, financial planning, and major construction and development projects. We have made considerable progress in our low-carbon transition since committing to 2030 interim targets and our long-term 2050 net zero target in FY21. In FY22, 56% of our electricity needs were met through renewable energy with our renewable electricity position increasing to 66% by the end of the period. We have also continued our efforts in developing physical climate-related assessments across our assets and have begun to define the potential associated financial implications.

Our Climate Change Framework ([Figure 1](#)) outlines the climate-related strategic risk (threats and opportunities) themes and direction to prioritise our efforts in the net zero transition, and ensure we operate resilient infrastructure into the future. The climate-related risk themes are consolidated into four threats and two opportunities, which capture the various climate-related risk themes identified by TCFD Implementation Guidance released in October 2021³. These strategic threats and opportunities link to the broader strategic business direction and define a clear, top-down approach to help identify key external trends and drivers, and our potential exposure. Further detail and our progress against these threats and opportunities are outlined in [Table 4](#).

These commitments, targets and initiatives are underpinned by our business-wide Sustainability Strategy, which positions our business to make meaningful progress towards the United Nations Sustainable Development Goals (UN SDGs). We have commitments in place over short, medium, and longer-term time horizons to ensure an orderly and effective transition. [Figure 3](#) summarises our priority areas for the business to manage climate-related physical and transition risk.

³ TCFD Implementation Guidance 2021, Table A1.1
⁴ TCFD Implementation Guidance 2021, Strategy recommended Disclosure b)

3.2 Impacts of climate change on our organisation

Transurban's strategy is "By understanding what matters to our stakeholders, we create road transport solutions that make us a partner of choice." Climate change is likely to affect our strategy to some extent, from a risk (threat and opportunity) perspective.

Our infrastructure will likely face a range of climate-related physical risk drivers, both acute and chronic, which may lead to financial, operational, and service delivery impacts. In addition, transition risk impacts such as change in the regulatory environment, stakeholder expectations and broader disruption could lead to an unfavourable operating environment. A range of climate-related impacts have been considered across our organisation and are being monitored as outlined in [Table 2](#) below.

A review of priority climate risk drivers for Transurban was undertaken in FY22 in order to understand these potential organisational climate-related risks and associated materiality. Materiality in this context has been determined by the potential long-term horizon of the risk, likelihood the risk will be realised, and relationship with our organisational strategy and financial systems.

At this stage, in the short to medium-term, we expect the potential impacts to our business to be largely influenced by acute physical events such as extreme weather, bushfire or flooding. Changes in stakeholder expectations and in the regulatory environment, and disruptions to the broader road networks across each of our markets caused by acute extreme weather events could also affect our business and operations to some extent. Our organisational strategy is not expected to be materially impacted across these time horizons; however further investigation is planned from FY23 to FY25 to confirm this and quantify potential impacts.

Table 2: Transurban's response to the TCFD's Impact Categories

TCFD Impact category ⁴	Summary of potential organisational impact	Strategic climate-related threat or opportunity where this is monitored
Products and services	<ul style="list-style-type: none"> Continued escalation in fuel prices affecting customers. Cumulation of physical risk affecting customer access to our assets. 	Threats 1, 3 and 4 and opportunity 1
Supply chain	<ul style="list-style-type: none"> Cumulation of physical and transition risk affecting our supply chain leading to increased cost of materials, product availability shortage, and delivery delays. Need for proactive engagement with supply chain to mitigate potential climate-related risks. 	Threats 1 and 2, and opportunity 1
Adaptation and mitigation activities	<ul style="list-style-type: none"> Increased maintenance and rectification cost for assets not designed for projected physical threats. Need for proactive engagement with external stakeholders such as government partners to enhance climate resilience. 	Threats 2 and 4, and opportunity 1
Investment in research and development	<ul style="list-style-type: none"> Increased need for research and development; likely focused on the application of low-carbon materials. 	Opportunity 1
Operations	<ul style="list-style-type: none"> Cumulation of physical threats affecting customer and staff health and safety. Increased operating cost due to changing environment (physical and transition). 	Threat 2 and opportunity 2
Acquisitions or divestments	<ul style="list-style-type: none"> Consideration of climate change as part of due diligence 	Threat 1 and opportunity 1
Access to capital	<ul style="list-style-type: none"> Need to demonstrate robustness and transparency of climate change commitments and asset resilience. 	Opportunity 1

The potential impacts of climate change over a longer-term time horizon are more uncertain due to a range of variables, including climate projection confidence. Our organisation will likely be affected by both acute and chronic physical events, given these impacts are projected to be more severe and impactful over time. Further investigation is planned from FY23 to understand the potential longer-term impacts such as increased extreme rainfall intensity and resultant flooding, sea level rise and storm surge.

Broader network disruption is anticipated to arise. It is therefore important we continue to work with our government partners and key stakeholders to understand and respond to expectations and emerging requirements and continue to enhance our assets' overall resilience. A detailed investigation of arterial road systems and other infrastructure which feed into our roads and tunnels, and their associated resilience, is planned from FY24 to FY30.

We recognise it is important to also consider the potential implications of the accumulation of events and the interrelation of different events, such as sea level rise and storm surge. These projected longer-term impacts will continue to be assessed across the lifecycle of our assets through the implementation of infrastructure sustainability rating tools, ongoing climate risk and adaptation assessments, development of asset-specific CRAMPs, and continued stakeholder engagement.

To ensure we capture the evolving climate science projections and emerging market and regulatory trends, continued climate-

related assessments and ongoing monitoring are required. This will be undertaken through the delivery of our Climate Change Framework (Figure 3) which shows our priorities for resilient infrastructure and operations across short, medium and longer-term time horizons.

There is continued momentum in the prominence of climate-related risks across the regulatory and legal environment, and we expect this trend to continue. We consequently realise the importance of our continued transition to net zero, integration of climate-related risk across our organisational pillars and strategy, and governance of independent sustainability performance ratings for assets to ensure ongoing transparency in our climate change risk management and disclosure.

3.3 Testing resilience through climate-related scenarios

Our 2030 decarbonisation targets are validated by the SBTi and align with limiting climate change to 1.5-degrees. Within the business, we use three climate scenarios associated with global temperature increases to test possible future conditions. A detailed review of the trends and key assumptions for each of the three scenarios was undertaken

in FY22 to capture the most recent physical scientific findings by the IPCC, and the broader regulatory changes across the markets where we operate. Further work is required to consider the social cost of carbon (SCC) as defined by the IPCC within our scenarios.

We have considered each of the three climate change scenarios to understand the possible short, medium, and longer-term impacts to operational assets. The scenarios align with TCFD recommendations, the Australian government's commitments to meet the United Nations' Paris Agreement, and the IPCC's Representative Concentration Pathways (RCP 2.6, 4.5, 8.5). Through implementation and use of each scenario, a consistent set of assumptions inform our risk assessment and management process and enable us to consider a full range of possible outcomes.

Importantly, each of the three climate scenarios also present opportunities across the various time horizons. These include asset efficiencies through improved design, sustainable finance, adoption of innovative technology, the use of low carbon materials, and uptake of zero emission vehicles. We will continue to explore the significance of these opportunities to enable our business and operations to drive longer-term positive change and strengthen our organisational resilience.

—Case study—

Emergency Management Exercise on the Hills M2

In March 2022, the Business Resilience team conducted an emergency management desktop exercise with the NSW Business. The exercise was based on an extreme weather event impacting the Hills M2 Motorway and the broader Sydney region. Using the climate projections identified in the Hills M2 Motorway CRAMP, the aim of the exercise was to provide an opportunity

to rehearse the response to a major adverse weather event and to further understand potential consequences of a period of excessive high temperatures on the asset, the surrounding community and customers. The exercise included both tactical and strategic response management teams to establish immediate response activities, and plan for ongoing safety, operational, financial, and reputational impacts. The exercise's objectives included:

- Review operational processes, including the notification, escalation, and activation protocols, between response management teams;
- Provide an opportunity for all parties to understand their role, as well as the roles of others during an extreme weather event; and
- Demonstrate preparedness and operational resilience as part of the Hills M2 Motorway CRAMP.

The complex scenario highlighted the importance of preparing the assets and response teams in the lead up to predicted extreme weather events and demonstrated the challenges of responding to a dynamic event, impacting multiple assets and communities.

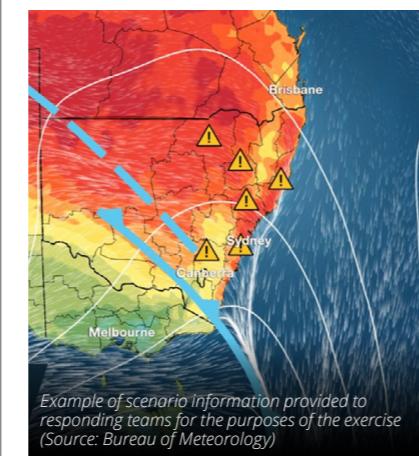


Figure 3: Current and future climate-related risk management priorities



* Time horizons indicate EOFY and are not to scale
All GHG targets are relative to a 2019 base year

3.4 Key studies and engagement undertaken in FY22

Several studies and engagement activities were conducted in FY22 to further understand potential organisational impacts associated with climate change. We continue to build our knowledge base on potential longer-term asset adaptation measures, and associated adaptation pathways to transition and enhance our resilience over time.

An outline of the detailed assessments and engagement activities is provided below:

- Enterprise physical climate-related risk materiality assessment:** We engaged a climate specialist to undertake a detailed review and assessment of priority climate risk drivers across our operational assets. The purpose was to understand potential materiality across the organisation associated with physical climate change impacts. This study will inform part of a broader financial climate-related assessment to be conducted from FY23, which will define key financial metrics associated with our organisation's material climate-related risks.
- Case studies reflecting on extreme climate events already experienced:** An interactive workshop was held with key stakeholders from each Australian market to discuss how recent extreme weather events experienced in each region affected the operations and resilience of our assets. The outputs from each workshop informed where potential material risks could lie over the longer-term time horizon, and further support the enterprise physical climate risk materiality assessment (mentioned above).
- Climate scenario review:** We undertook a detailed review of our three climate scenarios to capture the most recent physical scientific findings by the IPCC, the United Nations Climate Change Conference (COP26 summit) outcomes, and the broader regulatory changes across Australia and North America. Our scenarios align with RCP 2.6, 4.5 and 8.5, and include characteristics such as carbon market and pricing, technology, stakeholders and regulation, and physical science.
- Emergency management exercise on the Hills M2:** Taking into consideration the outcomes of the climate risk and adaptation assessment developed in FY21 for the Hills M2 Motorway, the Business Resilience team conducted an emergency

management desktop exercise with the NSW Business based on the extreme weather projections for the asset. The scenario highlighted the importance of preparing the asset and response teams in the lead up to predicted extreme weather events and demonstrated the challenges of responding to a dynamic event.

- Climate-related risk analysis across our supply chain:** As a result of indirect engagement with our major suppliers, an analysis was conducted to understand the potential impacts of climate-related physical and transition risk across our supply chain. This will inform future engagement to define areas of opportunity and further risk mitigation with our suppliers.

• Infrastructure Sustainability (IS) Operations rating on the Hills M2

Motorway: We have submitted an IS Operations Rating on the Hills M2, and are awaiting the final verified outcome. As part of the rating, a detailed climate risk and adaptation assessment was completed, and the highest possible score for the assessment was verified. This means that over 50% of the identified adaptation actions have been implemented in line with the time implementation thresholds, and the assessment aligned with all operational requirements of the IS Rating Scheme.

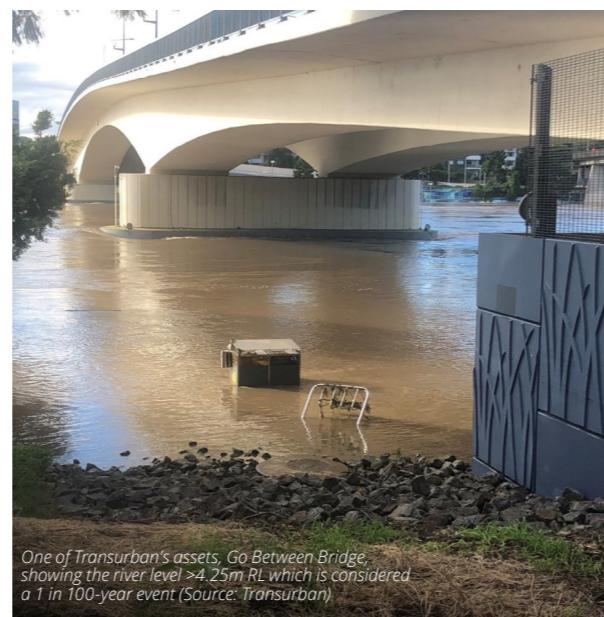
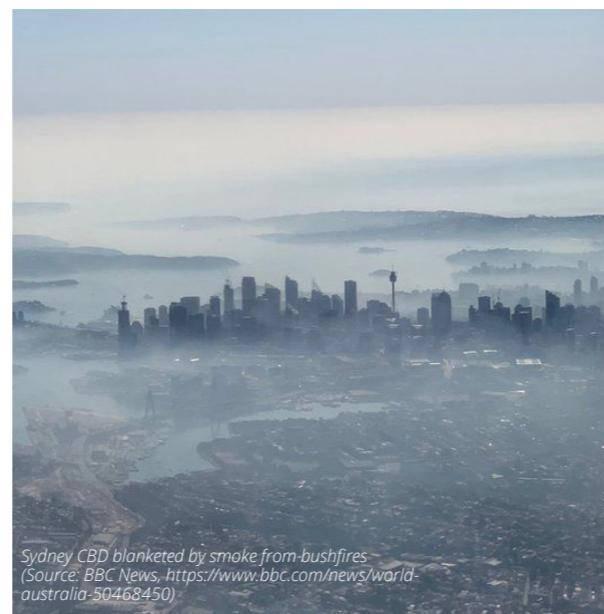
• Queensland open road and tunnel climate risk adaptation assessment:

Detailed climate risk and adaptation assessments were undertaken on two Queensland assets to understand possible adaptation required across short, medium, and long-term timeframes. The assessments considered potential impacts on an open road (Gateway Motorway) and a tunnel asset (Legacy Way). Given the timing of when the assessments were conducted, integration of the February 2022 flooding event was considered and reviewed during the process.

• WestConnex M4-M5 Link Tunnel design and construction:

A workshop and subsequent review was held with the WestConnex and the contractor (ASJV) teams to discuss the climate-related risk and adaptation measures implemented on the M4-M5 Link tunnels from the design and construction phases of asset, prior to the asset becoming operational. The purpose of the workshop was to capture the applicable climate-related risks for integration into Transurban's risk management system for ongoing monitoring by the WestConnex Operation and Maintenance team.

(Continued on page 18)



—Case study—

Reflecting on extreme climate events experienced and asset resilience

Melbourne: Severe storm event

Climate event background:

On 27 and 28 January 2022, thunderstorms brought strong winds, heavy rainfall, hail, and flash flooding to the western and central parts of Melbourne. Hailstones measuring three centimetres were reported, in addition to damaging lightning strikes causing power outages and flash flooding.

Observed impacts on our assets and operations:

Based on a workshop with market stakeholders in Victoria, the impacts of the severe storm event were discussed in terms of the asset performance and operations. The road and tunnel design were considered resilient to severe storm events due to design features such as drainage designed for large rainfall events. Severe storms impacted construction both directly and indirectly by generally generating delays. Impacts included reduced crane operations in severe winds and stop work and safe work orders onsite. These impacts however were not considered significant.

Direct impacts to operations observed during this storm event were mostly confined to flooding hotspots such as on-ramps, or where the assets joined other networks. The severe storm event produced minor operational impacts. Minor maintenance issues were also reported such as clearing fallen branches on the roadside. Despite the severity of lightning strikes and grid failures during the event, power outages were not problematic because the assets have dual feed power systems from different suppliers and back-up power networks capable of providing supply over an extended period.

Reflecting on the storm event and associated direct and indirect impacts, the group collectively noted minimal overall impact.

Sydney: Black Summer bushfires

Climate event background:

In December 2019 and January 2020, drought and a heatwave in Sydney saw temperatures reach around 45°C and create favourable conditions for persistent bushfires. Smoke and dust storms created poor air quality and reduced air quality and visibility in the area. As a result of these conditions persistent bushfires were generated which led to indirect impacts of smoke and dust storms causing poor air quality and reduced visibility in Sydney.

Observed impacts on our assets and operations:

The compound event was discussed in a workshop held with market stakeholders in NSW. Significant pressure on the air-conditioning units in Intelligent Transport Systems (ITS) equipment rooms on open road assets was noted, with the lifespans of these units known to be considerably reduced with excessive prolonged heat and increased workloads. On the Hills M2 and M5 Southwest, both open road motorways, near misses were reported from localised bushfires. There were no reported issues with the prolonged heat or drought on the geotechnical integrity of the assets, and landscaping was found to be resilient due to the hardy, drought-tolerant Australian natives planted.

From an operational perspective, the excessive heat resulted in stop work orders and health and safety concerns for outdoor staff and contractors, particularly those involved in landscaping-related maintenance activities. There was also an increase in vehicle breakdown frequency during the peak heatwave events.

Visibility was impacted by smoke haze and as a result speed restrictions were imposed for safety purposes.

Overall, the group noted there were impacts experienced across the assets due to the compound of events, predominantly for the open road assets. However, the controls in place ensured that the assets remained safe and operational.

Brisbane: East-coast flooding event

Climate event background:

A back-to-back La Niña event persisted throughout 2021 and into 2022 generating above average rainfall across Greater Brisbane. A total of 792.9mm of rainfall was recorded in Brisbane City over 6 days from 23 to 28 February 2022, which is 78% of the annual average rainfall. This rainfall led to significant river and creek level rises, causing extensive and significant flooding along the Brisbane River.

Observed impacts on our assets and operations:

A workshop was held with market stakeholders in Queensland to reflect on the extreme event experienced. Most of the reported impacts occurred during the acute period of intense rainfall in the last week of February 2022. Open road assets are designed for 1 in 100-year rainfall events, and tunnel assets for 1 in 1000-year events. They were therefore largely resilient to this event. Geotechnical impacts to open road assets such as embankment slips were noted as the most significant. Low lying roadside cabinets were also inundated and full replacement was required post-event, which resulted in some minor cascading impacts to services and operations.

Pleasingly, all assets remained open and direct impacts on operations were relatively minor. The pumping systems proved to be effective where localised flooding was experienced, and some back-up tankers were deployed to prevent overflows.

Taking into consideration the scale and extreme intensity of the event, the group concluded that inundation impacts were relatively minor and short lived. A comprehensive internal post incident review was conducted to ensure both the resilience of the assets and future lessons learnt were captured.

In the short-term, from FY23 to FY25, we will focus on continuing to develop asset-specific CRAMPs across our Australian and North American markets, and start assessing the financial implications associated with the physical impacts of climate change. Through these assessments, we will enhance our current understanding of the longer-term impacts of climate change and potential financial impacts. Additional studies to determine the broader network impacts of extreme weather events, in line with the management priorities identified in our Climate Change Framework, are planned from FY24.

3.5 Our progress towards understanding financial impacts

Climate change poses both a threat and an opportunity to our business. It could therefore potentially have a range of impacts on our financial performance. The extent of financial impacts on our business relies on our organisational response to the various risks and associated adaptation pathways identified, continued integration of climate-related risk with our operational and financial processes, and our effectiveness in capitalising on emerging opportunities. Our current understanding of climate-related financial risk is that climate change may have an impact on one or more of the TCFD's four major financial categories (revenues, expenditures, assets and liabilities, and capital and financing) particularly over the long-term. We have previously mapped the potential climate-related financial impacts on our business against these categories.

In FY22 we engaged a climate specialist to undertake a detailed review and assessment of priority climate risk drivers to understand the potential materiality across the organisation associated with physical climate change impacts. This study will inform a broader financial climate-related assessment to be conducted from FY23, which will define key financial logic maps and metrics associated with our material climate-related risks.

As part of the study, we have mapped at a high-level the potential impact flow, intermediate implication, and associated outcomes which could affect our financial

processes. An example of a climate-related logic map is illustrated in Figure 4 for the risk of increased instance of extreme rainfall. In this example extreme rainfall could lead to financial impacts on revenue and maintenance costs and have two key financial reporting impacts on our financial statements: firstly, lower revenues and higher costs could impact the valuation of our concession assets and secondly, bringing forward expected maintenance activities could increase maintenance expense and maintenance provisions. We will continue to investigate these potential impacts in FY23 and beyond.

3.5.1 Group financial statement climate-related considerations

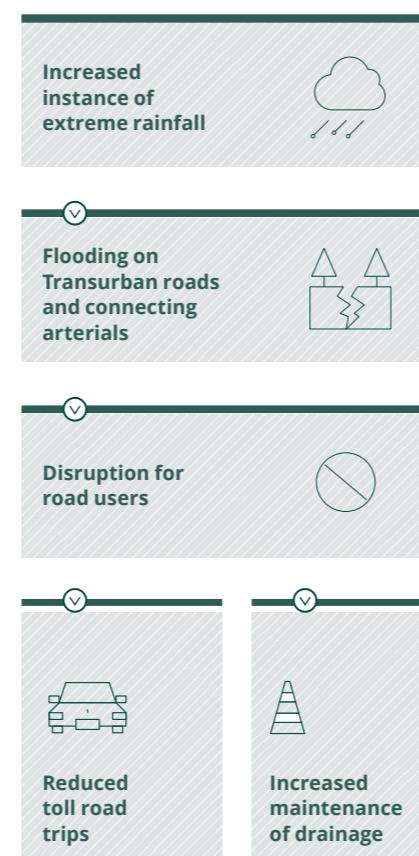
We have considered the potential financial reporting impacts and disclosures related to climate change in our financial statements, with particular reference to the Australian Accounting Standards Board/International Accounting Standards Board Practice Statement 2 Making Materiality Judgements (PSA/PS 2) which summarises the best practice interpretation of materiality in the context of the financial statements.

In FY22 we have updated our largely qualitative consideration of the potential financial reporting impacts on the Group's financial statements from the climate-related financial risks identified, through analysis of the studies and engagement activities conducted during the period. We have analysed the actual impacts of severe weather events already experienced in respect to our various assets ([refer to section 3.4](#)). The research and discussions with external advisors to date indicate that the key potential impact areas may include impairment of assets, maintenance provisions, contingent liabilities as well as expenses.

We note that our financial statements include assets and liabilities supported by cash flows that extend into the medium and long term, and climate change could have financial impacts particularly over the long-term that may impact our financial statements. Further work is required to better understand the potential financial impacts and therefore financial reporting impacts. We will also consider the potential impacts of the proposed ISSB's first two standards for future Disclosures⁵.

As our understanding of financial impacts progresses into the future, we will also seek to embed climate-related data into the measurement of impacted financial statement line items.

Figure 4: Example climate-related logic map for increased instance of extreme rainfall



Section 4: Risk management

4.1 Climate change risk management

Climate change is considered a strategic business risk ([refer to Corporate Report, Governance and Risk management section](#)).

We identify and manage climate-related risks through our business-wide Climate Risk and Adaptation Guideline. Aligning with and supporting Transurban's enterprise approach to risk management, the Guideline describes the process we use to identify, assess, manage, and escalate climate-related risks and document them in asset-specific CRAMPS which ensures we are operating as a business within our risk appetite. We continue to develop asset-specific CRAMPS for our operational assets in each market and have also integrated climate-related risk into our Strategic Asset Management and Operations Plan, as well as at a business and strategic level. These Plans are also integrated into our business resilience activities and enable teams to exercise and enhance their response to climate-based disruption events. A high-level summary of our climate change risk management process is outlined in Table 3 below.

Given climate-related risk continues to evolve, it is essential to monitor emerging trends, our climate-related metrics, changes across the regulatory environment and potential for disruption across our supply chains. A holistic review of our climate scenarios was undertaken in FY22, to ensure that assumptions and potential impacts remain up to date with the national and international trends, and latest physical climate science.

Table 3: Climate change risk management process

Key steps	Description
1. Training and engagement	Engage a multidisciplinary team. Where applicable, conduct a preliminary workshop to ensure consistent understanding of the climate change framework, supporting risk guidelines, and climate risk and adaptation identification process.
2. Climate research	Establish scope, context and criteria for climate risk assessment, and undertake relevant climate research aligned with climate scenarios across short, medium and long-term time horizons. Research historical and future climate data applicable to the scope of the assessment.
3. Plan	Collate previous climate-related risk assessments which are applicable, and obtain relevant design, maintenance and operational information to conduct the risk assessment.
4. Risk and adaptation identification	Complete a risk assessment in line with the ERM Framework, to identify the likelihood, impacts, consequence and risk rating in line with the climate projections from step 2. Conduct a workshop for both climate-related risk and adaptation to capture inherent and residual risk ratings.
5. Report	Develop a Climate Risk and Adaptation Management Plan (CRAMP) based on the workshops and stakeholder engagement. The Plan should include adaptation pathways to implement the applicable actions and mitigation measures over different time horizons.
6. Monitoring and review	Embed the CRAMP findings into Active Risk Manager (ARM) for ongoing monitoring and review by the applicable risk and action owners. Complete a review of strategic and operational climate-related risks every 12-18 months.
7. Audit and assurance	Test and confirm identified control measures, where applicable. Undertake ongoing audits of broader risk management processes.

Six strategic climate-related risk themes including four threats and two opportunities inform our Climate Change Framework ([Figure 1](#)). Climate-related operational risks, which apply to corporate services, our customer and asset teams, are identified, reviewed, and updated regularly. Business-wide climate-related risks are reviewed every 12-18 months or more regularly based on their potential consequence.

For new assets, we endeavour to include contractual requirements to undertake a climate change risk assessment, consider the impact of design and construction on the environment, and achieve third-party sustainability performance ratings. In Australia, all major construction and development projects are required to achieve at least an 'Excellent' IS rating through design and construction. The IS rating tool is facilitated by the Infrastructure Sustainability Council (ISC), and benchmarks best practice sustainability standards on infrastructure assets across planning, design, construction, and operation phases. Specific requirements for climate risk and adaptation are included in the tool, which drives projects to deliver innovative and resilient infrastructure under a worst-case scenario of approximately 4-degrees of warming by 2100. In North America, we have committed to achieving 'Envision' sustainability ratings from the Institute for Sustainable Infrastructure for two current major construction and development projects (Fredericksburg Extension and the 495 Express Lanes Northern Extension).

Within our supply chain, we regularly engage with our major suppliers to disclose GHG emissions, reduction targets and outcomes via CDP, which provides a standardised approach to data collection including noting the physical and transition climate-related risk components. We have assessed our first round of responses in FY22 which are detailed on the following page.

By integrating climate-related threats and opportunities into our risk management approach, systems and processes, we are well positioned to anticipate, manage, and ultimately strengthen the resilience of our business into the future.

Climate-related risk in our supply chain

To meet our interim scope 3 GHG emission reduction targets and long-term commitment to net zero GHG emissions and to ensure the resilience of our operations and business strategy, we seek to understand our suppliers' commitments to GHG reduction and addressing climate-related risks.

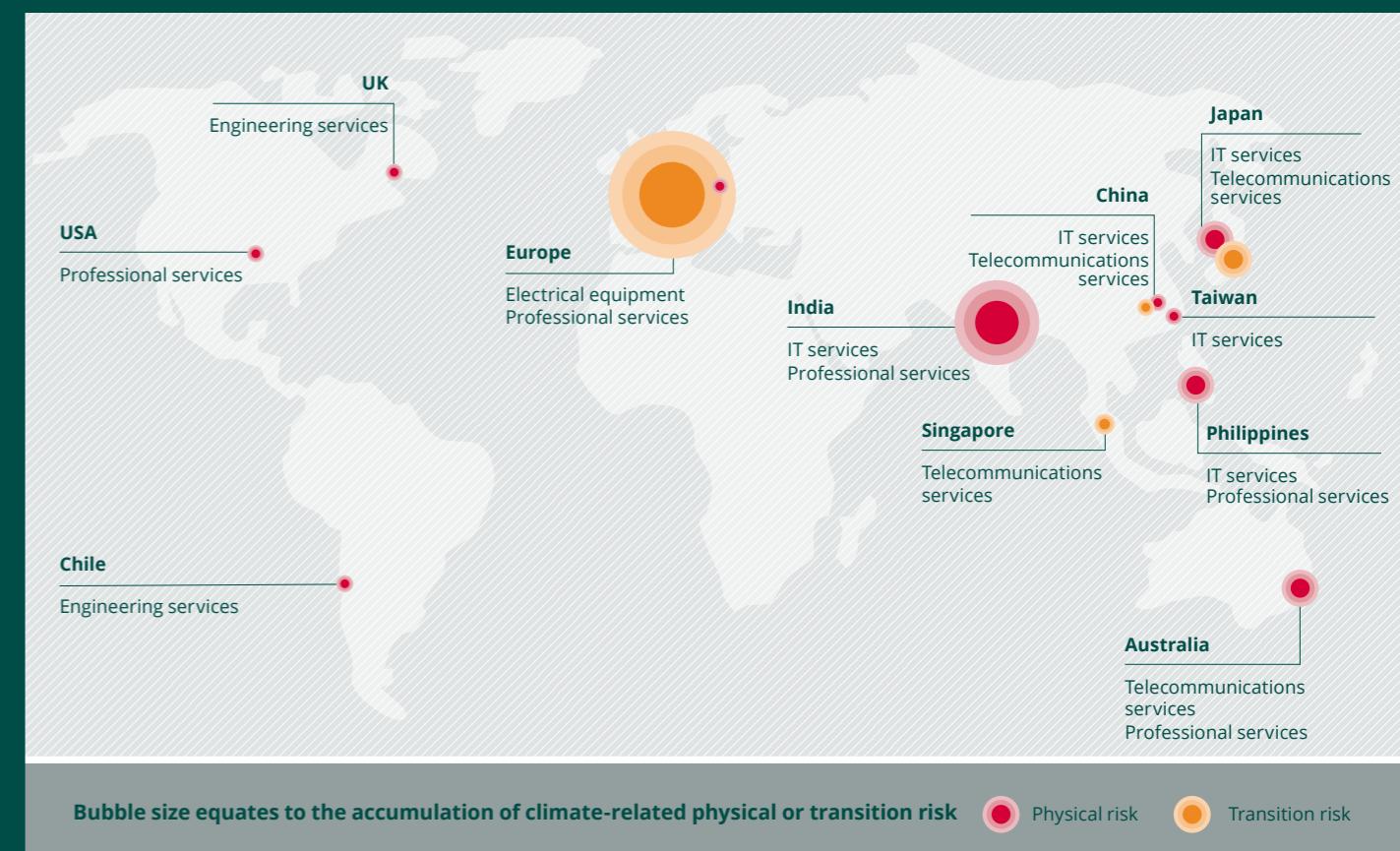
In FY22 we asked major suppliers (excluding our major construction and development projects) to participate in CDP supply chain reporting which provides a consistent climate change questionnaire for nominated suppliers.

The results provided us with a detailed understanding of the extent of risk identification, mitigation, and management by our top 50 major suppliers and some of their climate-related physical and transition risks. A total of 56 climate-related risks were identified by our suppliers who operate in the professional services, Intelligent Transport Systems (ITS) equipment, Information Technology (IT)

services, telecommunications service, and engineering services sectors. The findings are shown in Figure 5 below, with climate-related risks mapped against identified locations. The key geographical hotspots are highlighted below:

- **Japan:** suppliers identified physical risks relating to rising temperatures and extreme weather, and transition risks relating to carbon pricing and change in the regulatory environment.
- **India:** suppliers identified physical risks relating to increased severity and frequency of extreme events (namely cyclones, floods, and extreme heat) and variability in weather events.

Figure 5: Supply chain climate-related risk in FY22



4.2 Managing strategic climate-related risks

The strategic climate-related risk themes (threats and opportunities) and our responses are outlined in Table 4 below. The six themes represent our current understanding of the most material and relevant potential climate-related physical and transition impacts to our organisation and business operations across our three climate change scenarios. We consider possible impacts across different time horizons, the consequence and likelihood the risk will be realised, the relationship

with our organisational strategy and financial systems, and the effectiveness of existing controls. Our management response provides commentary of the interdependencies across the strategic risk (threat and opportunity) themes, and the relevant financial category which could impact our financial processes. Each risk theme is supported by detailed control and management measures at the organisation and asset levels where applicable.

Table 4: Our strategic climate-related risk response

Threats	
Threat 1: Unexpected changes to stakeholder expectations, government policies and regulations in relation to climate change create an unfavourable operating environment, impacting our reputation and financial performance	
Current risk rating	Medium
Relevant scenarios & timeframes	All scenarios (1.5°C, 2°C, 4°C) Medium-term
Relevant financial category*	Revenues, expenditures, assets and liabilities, capital financing
Relevant climate-related risk category**	Acute and chronic physical risk, policy and legal, market, reputation
Potential business impacts	<ul style="list-style-type: none"> Changes to infrastructure approval and concession deed requirements. Increased capital expenditure and operating costs. Increased risk of litigation associated with emissions and our contribution to climate change. Introduction of more stringent lending requirements. Community concern related to emissions affect travel and choice of transport method. Global supply chain impacts from carbon pricing, extreme weather events, pandemics (such as COVID-19) and resource constraints.
Our management response	<ul style="list-style-type: none"> Interim (2030) and long-term (2050) GHG emission reduction targets in place. Example of progress against these targets in FY22 includes: <ul style="list-style-type: none"> In FY22, 56% of our electricity needs were met through renewable energy with this increasing to 66% at the end of the period (all Australian markets now have renewable energy supply agreements in place); and We continue to pursue opportunities to reduce embodied GHG emissions in materials such as concrete and asphalt across the lifecycle of our assets. Continuing our sustainable procurement program and supplier engagement. We commenced annual reporting for our top 50 suppliers via the CDP – refer to the case study. Ongoing monitoring of environmental and climate-related litigation cases, and broader media and rhetoric such as greenwashing. Continuing to benchmark major project and operational asset sustainability performance against robust, third-party standards. In FY22 we submitted our first IS Operational rating (Hills M2 Motorway) and are awaiting the final verified outcome.
Short-term focus areas (FY23-FY25)	<ul style="list-style-type: none"> Continue our decarbonisation agenda to meet emission reduction targets. Continue implementing the sustainable procurement program, including engagement on identified climate-related risk areas. Engage government partners and industry to understand potential future changes to climate-related policy and regulations and responses. Start investigating possible wider network impacts across the markets where we currently operate. Continue to monitor and refine our climate-related metrics.

Threat 2:

Increase in incidence of severe weather events and average temperature affects lifecycle planning, disrupts operations, and increases operating costs

Current risk rating	Medium
Relevant scenarios & timeframes	2°C and 4°C scenarios Medium to long-term
Relevant financial category*	Revenues, expenditures, assets and liabilities
Relevant climate-related risk category**	Acute and chronic physical risk, market
Potential business impacts	<ul style="list-style-type: none"> Disruption to power supply, possibly leading to increased operating costs and increased likelihood of blackouts. Heat-related injuries affect employee/ contractor safety. Road user safety is affected in extreme weather events (water over road, reduced visibility). Disruption to asset lifecycle, causing delays and possibly increasing funding allocation.
Our management response	<ul style="list-style-type: none"> Adhering to and implementing robust design standards in accordance with best practice and state-mandated specifications which address weather-related impacts. Refer to section 4.3 for further detail. Continually monitoring asset performance, implementation of preventative and regular maintenance schedules, and ongoing asset inspections. Undertaking ongoing lifecycle planning processes for individual assets. Capturing existing and emerging risks and applying mitigation measures via our HSE management and risk management systems and processes. This includes development of asset-specific CRAMPS, and integration of identified risks and adaptation measures into the enterprise risk management software system, ARM. Applying our road safety approach which includes road safety action plans and performance measurement. Conducting climate-related risk reviews to ensure emerging trends, threats and opportunities are captured.
Short-term focus areas (FY23-FY25)	<ul style="list-style-type: none"> Continue the development of asset-specific CRAMPS, expected to be complete across our markets by FY24. Develop and implement a climate change training module in FY23 for relevant teams. Commence detailed financial impact assessment in FY23, based on the climate-related logic maps defined this year.

Threat 3:

Macroeconomic/ land use changes, caused by climate policy, and severe weather events, alter city travel patterns, development opportunities, and toll road use impacting traffic models and revenue

Current risk rating	Low
Relevant scenarios & timeframes	All scenarios (1.5°C, 2°C, 4°C) Long-term
Relevant financial category*	Revenues, expenditures, assets and liabilities
Relevant climate-related risk category**	Acute and chronic physical risk, policy and legal, technology, market, reputation
Potential business impacts	<ul style="list-style-type: none"> Economic growth slows and affects future development/growth opportunities. Reduction in long-term revenue as city travel patterns shift due to climate impacts.
Our management response	<ul style="list-style-type: none"> Ongoing monitoring of travel patterns and patronage across the markets where we operate through our strategic traffic modelling capability. Ongoing monitoring of our valuation and project due diligence processes. Continued tracking of national and global climate policies, changes to insurance and city planning, and the rate in which Australia and North America transition to renewables.
Short-term focus areas (FY23-FY25)	<ul style="list-style-type: none"> Commence detailed financial impact assessment in FY23, based on the climate-related logic maps defined this year; and Continue investigating and monitoring long-term transition and physical impacts across our asset operations.

Threat 4:

Access to and use of our roads and tunnels is impacted during extreme weather events and in periods of extended rain/heat

Current risk rating	Medium
Relevant scenarios & timeframes	2°C and 4°C Medium to long-term
Relevant financial category*	Revenues
Relevant climate-related risk category**	Acute and chronic physical risk, reputation
Potential business impacts	<ul style="list-style-type: none"> Changes to toll revenue. Changes to traffic patterns and forecasts. Impacts on customer safety.
Our management response	<ul style="list-style-type: none"> Ongoing implementation of asset-specific CRAMPs to identify potential hotspots on our operational assets. Ongoing monitoring of the development and implementation of resilience and adaptation plans for surrounding (non-Transurban) road and tunnel infrastructure.
Short-term focus areas (FY23-FY25)	<ul style="list-style-type: none"> Further investigation of behaviour and travel pattern changes during extreme weather events and the surrounding (non-Transurban) road infrastructure's level of resilience. Continue to monitor and refine our climate-related metrics. Ongoing engagement and cooperation with government partners to help improve overall city resilience.

Opportunities**Opportunity 1:**

Showcase our leadership in climate-risk management to open new market opportunities, strengthen relationships with existing government partners, and capitalise on innovation opportunities

Current risk rating	High
Relevant scenarios & timeframes	1.5°C scenario Short to medium-term
Relevant financial category*	Revenues, expenditures, assets and liabilities, capital financing
Relevant climate-related risk category**	Acute and chronic physical risk, energy sources, products and services, markets, resilience, resource efficiency
Potential business impacts	<ul style="list-style-type: none"> New market opportunities. Favourable lending rates. Increased trust and reputation with community and other key stakeholders. Partnership opportunities for research and innovation.
Our management response	<ul style="list-style-type: none"> Implementing Transurban's Sustainability Strategy which aligns with the UN SDGs which is driving transformative outcomes across the business (Strategy addresses opportunities including energy efficiency, GHG emission reduction, and climate risk management). Active engagement and partnering with our supply chain, government partners, and industry to enhance sustainability outcomes for our projects, assets, and communities. Continue to drive implementation of lower emission materials into the future via our role as a founding member of the Materials Embodied Carbon Leaders Alliance (MECLA). Strengthen asset resilience into the future through improved technologies and implementation strategies. Ongoing disclosure and engagement with our investors.
Short-term focus areas (FY23-FY25)	<ul style="list-style-type: none"> Develop and implement a compulsory training module for relevant teams in FY23. Ongoing involvement with MECLA. Ongoing engagement and partnerships with our supply chain, government partners, and industry.

Opportunity 2:

Take proactive steps to reduce scope 1, 2 and 3 greenhouse gas emissions and customer emissions, and transition to Net Zero

Current risk rating	High
Relevant scenarios & timeframes	All scenarios (1.5°C, 2°C, 4°C) Short to medium-term
Relevant financial category*	Revenues, expenditures, assets and liabilities, capital financing
Relevant climate-related risk category**	Acute and chronic physical risk, energy sources, products and services, markets, resilience, resource efficiency
Potential business impacts	<ul style="list-style-type: none"> Mitigate impacts associated with any carbon taxes and fluctuations in pricing. Reduce operating expenditures (energy). Demonstrated leadership in sustainability. Improved trust and reputation with stakeholders.
Our management response	<ul style="list-style-type: none"> Energy reduction through progress towards our 10 in 10 target – In FY22 we completed several major energy efficiency initiatives bringing our total energy efficiency savings to 8.3%, reducing our annual energy consumption by 46,815 GJ. In FY22, 56% of our electricity needs were met through renewable energy, with this increasing to 66% at the end of the period. Continuing to review and implement, where feasible, lower-carbon and circular materials on current and new assets. Continuing to commit to low-carbon materials on our major construction and development projects. For example, the WestConnex M4-M5 Link Tunnels project is using high supplementary cementitious material (SCM) content in concrete mixes.
Short-term focus areas (FY23-FY25)	<ul style="list-style-type: none"> Develop a corporate Low-carbon and Circular Materials Strategy to increase the use of low-carbon alternatives and reduce associated GHG emissions. Continue to implement energy efficiency initiatives and fleet transition to zero emission vehicles (ZEVs). Work to reduce customer emissions through encouraging uptake of ZEVs, promoting eco-driving practices and optimising our infrastructure.

* Financial category aligns with the TCFD categories, based on high-level financial impact mapping

** Climate-related threats have been mapped against the TCFD categories outlined in the TCFD Implementation Guideline 2021 Table A1.1, and climate-related opportunities have been mapped against the TCFD Implementation Guideline 2021 Table A1.2

WestConnex M4-M5 Link Tunnel design and construction

Transurban's major construction and development projects are required to undertake a climate-related risk assessment as part of the design and construction phases.

Sydney's M4-M5 Link Tunnels are the final component of WestConnex and feature twin tunnels between the New M4 at Haberfield and the M8 at St Peters, and stub tunnels to Rozelle Interchange.

A detailed climate-related risk and adaptation assessment was undertaken for the project to identify current and future adaptation actions and mitigate risks over the forecast useful life of the asset. Climate-related risks are being mitigated according to optimal scale and timing by considering distribution and severity. The adaptation pathways approach was adopted for risk treatment. To guide the selection of adaptation options AS5334:2013 Climate change adaptation for settlements and infrastructure – a risk-based approach, was used. Considerations included:

- effectiveness and robustness of adaptation over the life of the infrastructure, including the flexibility to respond to changing climatic conditions;
- practicability of implementation including consideration of related operational and maintenance activities;
- economic efficiency of operation and ongoing maintenance; and
- greenhouse gas emission implications.

During the design and construction phase, risks were mapped to design packages to identify adaptation options that could be applied during design and construction. For example, temperature and heatwave risks to tunnel equipment may have impacted four design packages: durability, ventilation equipment, instrumentation, and monitoring. The severity of risks was considered to understand their distribution and prioritisation for integration into the design.

The project has ultimately embedded a range of mitigation measures into the design of the asset, in line with the adaptation pathways approach. Design features implemented to enhance asset resilience include:

- **Flood mitigation design features** such as conservative groundwater infiltration measures, sump-and-pump redundancy and associated sizing to delay overflow, back-up power for emergency equipment, appropriately sized Gross Pollutant Traps for drainage systems, and the ventilation building floor level is set at appropriate flood levels to allow for the modeled climate scenarios.
- **Durability assessment** of the materials used to construct the tunnels. This included concrete reinforcement designed to prevent the initiation of corrosion and the use of non-reactive aggregates.
- **Backup power and battery systems** installed to cater for the event of a broader network power failure. For example, there are two uninterrupted power systems (UPS) provided for each substation. The UPS will also power emergency lighting and signage.

Next steps:

When the M4-M5 Link Tunnels open to the public and become operational, the WestConnex risk, sustainability, and operational and maintenance teams will undertake a detailed review of the assessment.

The climate-related risks and opportunities applicable to the operational phase of the asset will be integrated into our risk management system for continued monitoring and review. This is planned to occur in FY23.



—Case study—



—Case study—

Queensland operational climate risk assessments

Outline of assessment scope for operations:

Queensland was identified as a priority market in FY22 to target our asset-specific climate risk and adaptation assessment efforts. This is due to the extent and intensity of the various climate projections for the Brisbane region including increased intensity of storm events, variance of rainfall and sea level rise. The recent flooding event experienced in the Brisbane area in early 2022 (as mentioned in an earlier case study) was also integrated into the assessments given the timing, significance, and relevance of the event.

Legacy Way tunnel and Gateway Motorway, an open road asset, were investigated in detail, and a CRAMP developed for each of the two assets. The climate impacts considered included hot days and heatwaves, rainfall and flooding, bushfire weather, sea level rise, and cumulative climate change impacts, inclusive of transition risk. Detailed climate-related risk assessments were undertaken in line with RCP 8.5 to assess the worst-case scenario and ensure a high level of resilience across the Brisbane market.

Building on the risk register and adaptation options identified, additional adaptation pathways workshops were undertaken to identify the optimal scale and timing of key adaptation actions, and to understand their potential thresholds

and triggers for implementation over the operational life of the asset. The output of these workshops was two adaptation pathways, which determined adaptation action implementation across the short, medium, and longer-term time horizons, to incorporate flexibility into decision-making and account for future uncertainties.

The adaptation pathways were:

- How can Transurban Queensland maintain a safe environment for customers and employees of the asset given the projected increases in the intensity of extreme weather events?
- How can Transurban Queensland maintain successful and profitable motorway operations in the face of accumulating physical impacts on the asset, namely the increase in intensity of extreme weather events?

Findings and next steps:

Adaptation actions to address key risk areas have been developed to ensure that relevant and practical mitigation measures are implemented at a scale and timing that is appropriate, in response to defined thresholds and triggers. The effectiveness and progress of the adaptation pathways and associated adaptation actions will be reviewed as part of the annual risk review process for the market. We plan to develop asset-specific CRAMPs for the remaining assets in the Queensland market during FY23.

Adaptation actions to address key risk areas have been developed to ensure that relevant and practical mitigation measures are implemented at a scale and timing that is appropriate, in response to defined thresholds and triggers.



4.3 Possible long-term climate-related physical risk for asset components

We have analysed possible long-term impacts across individual asset components using the most extreme climate projections aligned with a 4°C scenario and identified potential impacts likely to occur from now until 2100. The climate projections align with the latest data published by the IPCC and RCP 8.5 projection data. The analysis combines market-specific data which capture differences across asset locations and the broader markets where we operate.

Our assets are designed and delivered in accordance with industry best practice and state-mandated specifications which address weather-related impacts. As a result, our assets have a strong level of resilience incorporated into their design. A long-term timeframe and extreme climate scenario have been used given the forecast useful life of infrastructure assets, our long operational concession periods, and the opportunity to capture and prepare for worst-case climatic

changes. These potential long-term impacts and control measures will be incorporated into asset-specific adaptation plans over the coming years. Table 5 summarises the possible long-term impacts, current controls and any short-term actions required to better understand or manage each respective risk. This information informs our climate risk management process and broader Climate Change Framework.

Table 5: Potential long-term impacts and actions by asset component (4°C scenario aligned with RCP 8.5 projection data)

Asset components	Potential impacts
Structures and surfaces	
Summary of projections	
Temperature increases <i>Increase in average temperatures and more frequent occurrence of heat waves</i>	<ul style="list-style-type: none"> Accelerated deterioration of exposed surfaces and structures
Extreme weather events <i>Increased intensity and volatility of storms including hail, lightning, wind, and rainfall</i>	<ul style="list-style-type: none"> Storm surge causing damage to structures and footings Accelerated deterioration of exposed surfaces and structures
Drought <i>Decrease in annual rainfall resulting in extended periods of drought and subsequent increase in fire danger</i>	<ul style="list-style-type: none"> Subsidence following drought reduces soil stability and impacts structures Potential fire damage to road surfaces
Sea level rise <i>Rising sea levels as polar icecaps melt and thermal expansion occurs</i>	<ul style="list-style-type: none"> Increased salinity leads to corrosion of structures and materials Permanent inundation of footings and low-lying structures Destabilisation due to scour
Snow and ice* <i>Decrease in snow and ice storms due to warming temperatures</i>	<ul style="list-style-type: none"> Permanent inundation of footings and low-lying structures
Examples of current controls	<ul style="list-style-type: none"> Existing design standards (for example design for 1 in 100-year flood) Operations, maintenance and engineering-related management plans, procedures, and systems in place for structural deterioration, changes, or disruption Preventative and regular maintenance schedules Asset-specific lifecycle models Engineering inspections of structures
Actions for consideration over short and medium-term time horizons	<p>Short-term:</p> <ul style="list-style-type: none"> Progressively implement asset-specific adaptation plans (CRAMPs) Develop pavement strategy and incorporate climate projections Monitor the asset elements' vulnerability to the climate context and incorporate into the asset lifecycle model <p>Medium-term:</p> <ul style="list-style-type: none"> Explore opportunities for smart monitoring systems

* Applicable to our North American market only based on a preliminary assessment

Non-structural, roadside furniture and landscaping

Summary of projections	Potential impacts
Temperature increases <i>Increase in average temperatures and more frequent occurrence of heat waves</i>	<ul style="list-style-type: none"> Adverse impacts to plant health Accelerated wear of surface coatings (for example, paint and façade panels)
Extreme weather events <i>Increased intensity and volatility of storms including hail, lightning, wind, and rainfall</i>	<ul style="list-style-type: none"> Landslides and erosion Damage to vegetation plantings Hail damage to roadside furniture
Drought <i>Decrease in annual rainfall resulting in extended periods of drought and subsequent increase in fire danger</i>	<ul style="list-style-type: none"> Landslides and erosion Adverse impacts to plant health
Sea level rise <i>Rising sea levels as polar icecaps melt and thermal expansion occurs</i>	<ul style="list-style-type: none"> Flooding and damage to vegetation
Snow and ice* <i>Decrease in snow and ice storms due to warming temperatures</i>	<ul style="list-style-type: none"> Damage to roadside furniture and landscaping
Examples of current controls	<ul style="list-style-type: none"> Management plans, inspections and preventative and regular maintenance schedules Investigations into alternative, more resilient construction materials Existing design standards which our assets are designed to Regular arborist reviews across vegetated areas CCTV camera and operator monitoring to track any damage
Actions for consideration over short and medium-term time horizons	<p>Short-term:</p> <ul style="list-style-type: none"> Progressively implement asset-specific adaptation plans (CRAMPs) Monitor the asset elements' vulnerability to the climate context and incorporate into the asset lifecycle model <p>Medium-term:</p> <ul style="list-style-type: none"> Continued investigations into alternative, more resilient construction materials
Drainage	
Summary of projections	
Temperature increases <i>Increase in average temperatures and more frequent occurrence of heat waves</i>	<ul style="list-style-type: none"> Accelerated deterioration of exposed drainage surfaces and structures
Extreme weather events <i>Increased intensity and volatility of storms including hail, lightning, wind, and rainfall</i>	<ul style="list-style-type: none"> Reduced capacity of drains from rainfall and surrounding system overload Localised flooding on the network
Drought <i>Decrease in annual rainfall resulting in extended periods of drought and subsequent increase in fire danger</i>	<ul style="list-style-type: none"> Sediment build up as average rainfall decreases Potential fire damage to drainage surfaces and structures
Sea level rise <i>Rising sea levels as polar icecaps melt and thermal expansion occurs</i>	<ul style="list-style-type: none"> Reduced capacity of drains because of water backflow
Snow and ice* <i>Decrease in snow and ice storms due to warming temperatures</i>	<ul style="list-style-type: none"> Reduced capacity of drains due to additional runoff and less frequent snow/ice events
Examples of current controls	<ul style="list-style-type: none"> Existing design standards that account for a 1 in 100 year flood Incident response and road safety management processes Preventative and regular maintenance schedules in place Engineering inspections in place
Actions for consideration over short and medium-term time horizons	<p>Short-term:</p> <ul style="list-style-type: none"> Progressively implement asset-specific adaptation plans (CRAMPs). This will consider the impact of flooding events and sea level rise on current drainage systems Monitor the asset elements' vulnerability to the climate context and incorporate into the asset lifecycle model <p>Medium-term:</p> <ul style="list-style-type: none"> Model longer-term impact associated with rainfall and extreme weather events across the broader networks

Asset components**Technology/electrical****Summary of projections****Temperature increases**

Increase in average temperatures and more frequent occurrence of heat waves

Potential impacts

- Failure of equipment in extreme heat and due to temperature fluctuations

Extreme weather events

Increased intensity and volatility of storms including hail, lightning, wind, and rainfall

- Failure of equipment due to blackouts or damage from lighting/power surge

Drought

Decrease in annual rainfall resulting in extended periods of drought and subsequent increase in fire danger

- Potential fire damage to ITS components

Sea level rise

Rising sea levels as polar icecaps melt and thermal expansion occurs

- Potential damage to ITS components

Snow and ice*

Decrease in snow and ice storms due to warming temperatures

- Potential damage to ITS components

Examples of current controls

- Existing design standards and broader design considerations (for example, location of equipment being east or west facing)
- Ruggedised roadside equipment types are considered for newer installations
- Essential supplies for majority of our assets are backed by UPS and generators
- Temperature monitoring and automatic alarms are enabled at some mission critical systems such as tolling technical shelters

Actions for consideration over short and medium-term time horizons**Short-term:**

- Progressively implement asset-specific adaptation plans (CRAMPs)
- Monitor the asset elements' vulnerability to the climate context and incorporate into the asset lifecycle model

Medium-term:

- Consider design of critical roadside equipment to be more resilient to the impacts of lightning for future installations

* Applicable to our North American market only based on a preliminary assessment

Section 5: Metrics and targets

5.1 Climate-related metrics

We use climate-related metrics and targets to provide transparency on what we monitor and the progress we are making towards mitigating climate-related risks. Other sustainability and environmental metrics (such as water use, road injury crash index, waste diversion from landfill) are referenced in Transurban's [Insights Hub](#). As we continue to progress against our Climate Change Framework and our approach to climate

change evolves, we will continue to review and enhance our current set of performance metrics in line with TCFD guidance. Implementing the Recommendations of the TCFD 2021 Appendix 2, Cross-Industry Climate-Related Metric Categories. Further metrics may be added, and some may be changed or removed.

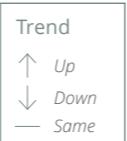


Table 6: Climate-related metrics and associated FY20 to FY22 trends¹

Metric	Unit of measure	FY20	FY21	FY22	Trend	Metric type	Financial category	Commentary
Threat 1: Climate change awareness and policies impact operation, reputation and financial performance								
T 1.1 Degree of alignment with government partner climate change policies	Weak/Moderate/Strong	Strong	Strong	Strong	—	Improve	Assets and Liabilities	Well-aligned to the growing ambition in this area and support current government policy.
Threat 2: Severe weather affects assets lifecycle and disrupts operations								
T 2.1 Number of recordable heat-related injuries that have occurred (Transurban employees and contractors) ²	Number	0	0	0	—	Monitor	Assets and Liabilities	
T 2.2 Weather-related traffic incidents on operational assets ³	Number	8	5	9	↑	Monitor	Assets and Liabilities	New metric included for FY22. Multiple severe weather events experienced such as major flooding in Queensland.
T 2.3 Operational assets with current high-level climate change risk assessments	%	80%	100%	100%	—	Monitor and improve	Assets and Liabilities	This metric refers to our business-wide high-level climate risk assessment conducted in FY21, which captured operational assets at that time.
T 2.4 Operational assets with a CRAMP in place	%	0%	5%	14%	—	Monitor and improve	Assets and Liabilities	New metric included for FY22. This metric refers to detailed CRAMPS developed, which utilises the business-wide high level climate risk assessment conducted in FY21 (refer to metric T 2.3). A CRAMP includes both a climate risk assessment and adaptation pathways for an asset.
T 2.5 Major projects under construction with finalised climate change risk assessments	%	100%	100%	50%	—	Monitor and improve	Assets and Liabilities	New metric added for FY22 (previously reported in our SDG Progress Report). For FY22 this included West Gate Tunnel, the WestConnex M4-M5 Link Tunnels which have completed a detailed climate risk assessment as part of the IS Rating As Built submission, and Fredex and 495 Express Lanes in North America which plan to complete a detailed climate-related risk assessment in FY23.

Metric	Unit of measure	FY20	FY21	FY22	Trend	Metric type	Financial category	Commentary
Opportunity 1: Demonstrate sustainability leadership								
O 1.1 CDP score ⁴	Rating	C	A-	B	↓	Improve	Assets and Liabilities	CDP benchmarks increased in FY22.
O 1.2 Cumulative weighted average Infrastructure Sustainability rating score ⁵	Points	80.2	76.5	76.5	—	Improve	Assets and Liabilities	Equivalent to a 'Leading' rating average (≥ 75 points).
Opportunity 2: Reduce emissions and move towards carbon neutrality								
O 2.1 Scope 1 emissions	tCO ₂ e	4,391	4,598	5046	↑	Improve	Assets and Liabilities	Increase in Scope 1 emissions from fuel due to new assets.
O 2.2 Scope 2 emissions	tCO ₂ e	135,426	191,743	101,346	↓	Improve	Assets and Liabilities	Significant decrease in scope 2 emissions due to greater renewable energy use.
O 2.3 Scope 1 and 2 emissions intensity ⁶	tCO ₂ e/\$m revenue	55.7	86.6	45.8	↓	Monitor	Assets and Liabilities	Significant decrease in emissions.
O 2.4 Scope 3 emissions ⁷	tCO ₂ e	634,566	428,366	412,593	↓	Improve	Assets and Liabilities	Emissions decreased as some major construction and development projects were completed.
O 2.5 Cumulative embodied GHG emission savings from major projects ⁸	tCO ₂ e	304,000	644,000	644,000	—	Improve	Assets and Liabilities	No change in major construction and development project materials and embodied emissions forecasts in FY22. Next revision expected in FY23.
O 2.6 Cumulative materials savings from major projects ⁸	Tonnes of concrete	58,000	234,000	234,000	—	Improve	Assets and Liabilities	No change in major construction and development project materials savings in FY22. Next revision expected with updated Infrastructure Sustainability rating completion of West Gate Tunnel and WestConnex M4-M5 Link Tunnels in FY23.
	Tonnes of asphalt	204,000	209,000	209,000	—			
	Tonnes of aggregate	120,000	130,000	130,000	—			

¹ Metrics T3.1 and T3.2 have been removed in FY22 as they no longer remain applicable to the respective threats, and new metrics will be considered in FY23 in line with the TCFD guidance, Implementing the Recommendations of the TCFD 2021 Appendix 2, Cross-Industry Climate-Related Metric Categories

² Heat-related injuries have remained zero over the past few years. With increasing temperatures, this will be monitored closely to capture the HSE impacts of extreme temperatures

³ Weather-related incident numbers based on reported incidents on our assets in Australia and North America through our HSE Reporting system

⁴ Transurban B grading is within the "Management" band in the CDP reporting scheme

⁵ Average verified IS Rating score of all projects to date, weighted by project capital cost. Design rating scores are replaced by As Built scores and may vary as each project moves through the two-phase IS Rating process

⁶ To determine Scope 1 and 2 emissions intensity, total revenue has been extracted from the profit and loss statement in corresponding years

⁷ Scope 3 emissions include the impacts of our supply chain purchases, major project construction, as well as corporate Scope 3 emissions associated with fuel, electricity, waste and business travel. Scope 3 emissions are expected to fluctuate year-on-year mostly with variation in construction activities, which are our largest Scope 3 emissions source

⁸ GHG savings and materials savings are from efficiencies in design and construction activity and the use of lower-emodied emission materials. Figures are based on Australian major project IS ratings, which measure reductions achieved from a 'Base Case' (initial design) through to 'Actual Case' (final project with sustainability initiatives implemented). Figures reported in each year are cumulative totals of all projects with completed ratings. Each project completes a 'Design' rating followed by an 'As Built' rating. Cumulative figures are updated to reflect the latest available rating for each project

5.2 GHG and energy targets and progress on our transition to a low carbon economy

Scope 1, 2 and 3 emission reduction targets

We have interim science-based and long-term GHG emission reduction targets and are reducing impacts associated with our direct operations and supply chain.

Our business

Achieve net zero across Scope 1, 2 and 3 GHG emissions by 2050

Reduce our absolute Scope 1 and 2 GHG emissions by 50% by 2030 (tCO₂e)

Achieve 10% energy efficiency savings by 2023 (2013 baseline), target savings 56,366 GJ

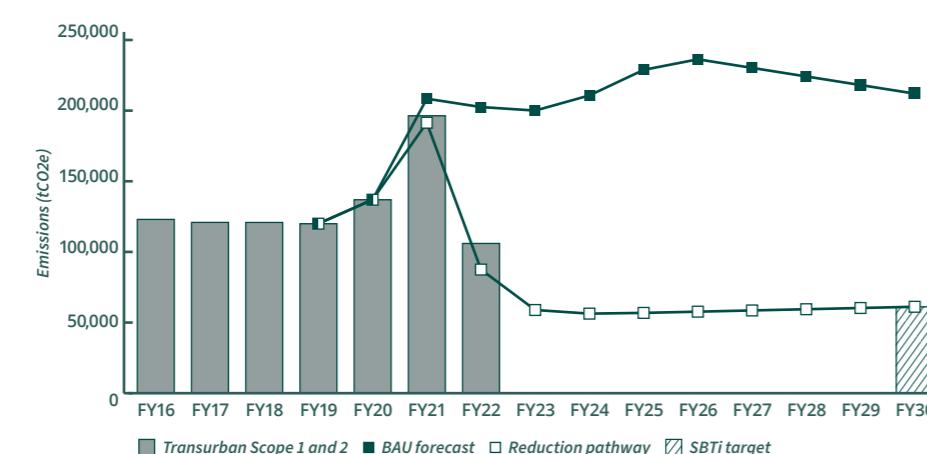
Our major projects

Reduce the carbon intensity across our major projects by 55% by 2030 (Scope 3 tCO₂e from major projects, per \$M project capital cost)

Our supply chain

Reduce the carbon intensity of the goods and services we purchase from suppliers by 22% by 2030 (Scope 3 tCO₂e from supplier spending, per kilometre travelled on our roads as a measure of our business output)

Figure 6: Scope 1 and 2 GHG emissions forecast



Scope 1 and 2 emissions decreased 45% in FY22 compared to FY21.

FY22 scope 1 and 2 emissions were 13% below 2019 levels with further reductions expected in FY23 as we continue to progress towards our science-based 50% GHG reduction target by 2030. To achieve our target we will continue to reduce energy consumption and transition to renewable energy.

Our 10 in 10 energy efficiency program has now delivered 46,815 GJ of energy savings to date across existing assets.

In FY22 significant tunnel ventilation optimisation projects were completed across several assets bringing our total energy efficiency savings to 8.3%. We continue to deliver a pipeline of energy efficiency projects towards and beyond the 10% reduction target.

Two-thirds of our electricity needs were met from renewable energy in FY22.

Several of our renewable energy Power Purchase Agreements (PPAs) and renewable energy agreements became operational in FY22 along with entering new contracts for remaining Australian assets. We are now operating with more than 66% renewable electricity with further increases expected in FY23 as new contracts become operational. We continue to investigate renewable energy opportunities in the US.

35 of our top 50 major suppliers engaged in the CDP climate change disclosure process.

Half of our major suppliers reported active GHG targets with the majority committed to science-based targets within the next two years. Our most recently completed major project (WCX M8) was delivered with a construction phase carbon intensity of 127 tCO₂e/\$M (30% below 2019 levels).

10 in 10 energy efficiency progress

To date, over 25 energy efficiency projects have been implemented across our operations, delivering total annual energy savings of 46,815 GJ, or around 8.3% of our 10% by 2023 energy efficiency target.

In FY22, several significant tunnel ventilation optimisation projects were completed. Tunnel ventilation systems require large amounts of power and typically account for more than 70% of total energy consumption. Utilising 3D modelling and simulations, our Advanced Data and Analytics Program team were able to optimise and fine tune ventilation systems for several Queensland tunnels' response to updated traffic profiles, ensuring fans are only on when they need to be while ensuring strict air quality standards continue to be met.

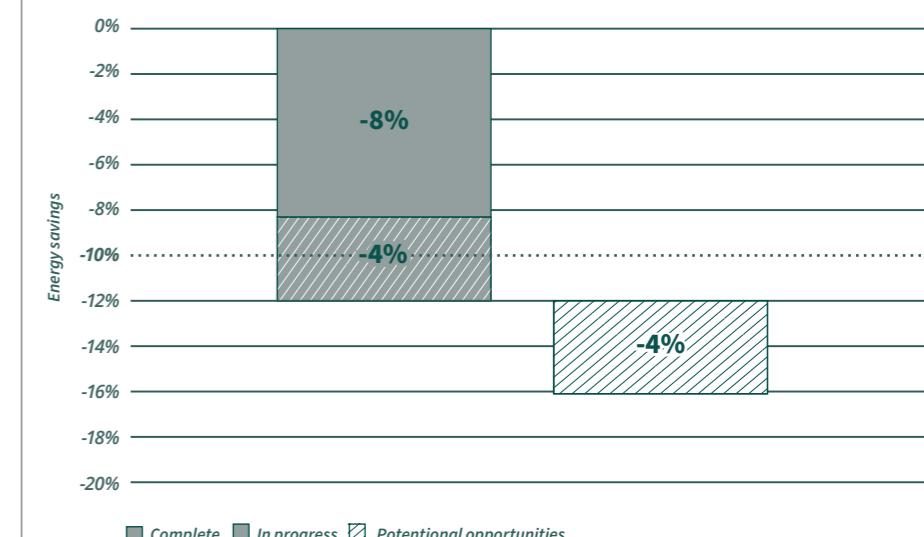
"The results have been a real success story for the Queensland business and for showcasing the power of applying Advanced Analytics to drive efficiencies around our core operations"
– Sue Johnson, Group Executive, Queensland

As we approach the 2023 target year, we are committed to delivering our pipeline of energy efficiency projects and will continue to explore further opportunities beyond 2023 aligned with asset lifecycle planning to drive further environmental and economic benefits.

Transitioning to renewable energy

Transitioning to renewable energy across all our markets is a key step towards achieving our interim 2030 science-based targets. In FY22 we reduced our GHG emissions by 45% from FY21 (13% below 2019 levels) as our renewable energy PPAs began providing significant volumes of renewable energy.

Figure 7: Progress to 10% energy efficiency savings by 2023 (2013 baseline)



Our second NSW PPA began providing renewable energy in June 2022, with our Sydney and Brisbane markets forecast to be more than 80% renewable from Q1FY23 onwards. Our Melbourne market is currently 50% renewable and we have committed to 100% renewable energy for CityLink from 2024 onwards. We are also exploring renewable energy opportunities in the US. FY23 will see further reductions in our GHG emissions as the Queensland and New South Wales PPAs operate for a full year.

Supply chain engagement

Transurban engages with major suppliers on GHG emissions reporting and reduction both directly and annually through the CDP Supply Chain program. CDP measures ongoing supplier engagement and progress towards GHG targets, with 35 of our top 50 major suppliers disclosing in FY22. Half of our responding major suppliers reported active GHG targets with the majority either

already having or committed to setting science-based targets within the next two years. Thirty-five per cent of the energy needs of disclosing suppliers was met from renewable energy. Insights gained from CDP disclosure inform our ongoing supply chain engagement strategy and pathway to our scope 3 reduction targets.

To achieve our scope 3 GHG reduction targets Transurban partners with government and industry to drive collective effort. We are a founding member of MELCA, an alliance of over 150 industry partners and government agencies, which aims to drive reductions in embodied carbon in Australia's building and construction industry.



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