



# BUILDING VICTORIA'S CLIMATE RESILIENCE



## Acknowledgement

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's lands and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices. We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

## Acknowledgements

**Design** cee.Design – carmel@cee.design.co

**Images** Cover unsplash.com/Weyne Yew, P. 1/21/22/29 State of Victoria, DELWP, P. 2 Adrian Martins, P. 5 Courtesy of City of Melbourne, Kelly Hertzog, P. 10 Maskot/Adobe Stock, PP. 11/12 Dja Dja Wurrung Clans Aboriginal Corporation, P. 13 istock.com/DLMcK, P. 15 Peter Clarke, P.16 Shuang Li/Adobe Stock, P. 17 Eastern Alliance for Greenhouse Action, P. 18 istock.com/Mark Piovesan, P. 19 istock.com/IPG Gutenberg UK Ltd, P. 20 istock.com/Monkey Business Images, P. 23 Department of Health, P. 25 Emergency Management Victoria, P. 26 Marcia Riederer, P. 27 Mr72, P. 28 unsplash.com/Stefano Borghi, P. 30 Department of Jobs Precincts and Regions/Greg Elms, P. 31 Department of Jobs Precincts and Regions/Dr. Holly Baird, PP. 32/33, Department of Jobs Precincts and Regions, P. 34 istock.com/FiledIMAGE, P. 35 Courtesy of City of Melbourne, D Hannah, P.36 istock.com/Imgorthand

© The State of Victoria Department of Environment, Land, Water and Planning, February 2022.



This work is licensed under a Creative Commons Attribution 4.0 International licence. You are free to re-use the work under that licence, on the condition that you credit the State of Victoria as author. The licence does not apply to any images, photographs or branding, including the Victorian Coat of Arms, the Victorian Government logo and the Department of Environment, Land, Water and Planning (DELWP) logo. To view a copy of this licence, visit [creativecommons.org/licenses/by/4.0/](https://creativecommons.org/licenses/by/4.0/)

ISBN 978-1-76105-867-7 (pdf/online/MS word)

## Disclaimer

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

This instrument has been made to give effect to the requirements in Division 1 of Part 5 of the *Climate Change Act 2017*.

## Accessibility

If you would like to receive this publication in an alternative format, please telephone the DELWP Customer Service Centre on 136 186, email [customer.service@delwp.vic.gov.au](mailto:customer.service@delwp.vic.gov.au), or contact the National Relay Service on 133 677, [www.relayservice.com.au](http://www.relayservice.com.au). This document is also available on the internet at [www.delwp.vic.gov.au](http://www.delwp.vic.gov.au)



# Our commitment to adapt to climate change

Victoria has confronted unprecedented challenges over the past few years, facing the COVID-19 pandemic and extreme events including the 2019–20 bushfires and multiple episodes of intense rainfall, floods and storms across our state.

We've weathered these challenges and shown what we can achieve when we work together.

Our collective spirit is vital as we consider what the unavoidable impacts of climate change mean for Victoria, and how our state will adapt to the warmer, drier climate, extreme weather, and slow-onset changes projected for the coming years and decades. Victoria needs to be ready to respond to the risks and opportunities of climate change.

Acting now to build our climate resilience not only reduces the potentially devastating costs of future climate impacts, but also creates immediate and lasting benefits for our health, economy and environment.

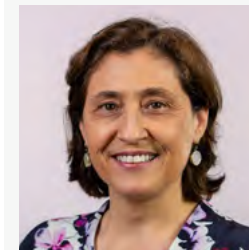
*Victoria's Climate Change Strategy*, released in 2021, outlines the Victorian Government's plan to achieve a cleaner, stronger and fairer Victoria – a clear pathway towards a net-zero emissions, climate-resilient, prosperous and liveable state. This includes a target to halve Victoria's emissions from 2005 levels by 2030.

*Building Victoria's Climate Resilience* sets out what Victoria is doing to adapt and build resilience to our changing climate.

Guided by the latest science, the Victorian Government's world-leading approach is built around our communities. We're working to understand the risks we face from climate change, support our most vulnerable people and assets, and prioritise solutions that will help protect the essential systems and services we rely on every day.

This report also introduces new Adaptation Action Plans for 7 systems across Victoria that are vulnerable to climate impacts or critical to building our state's climate resilience. These 7 plans are the centrepiece of Victoria's approach to systematically managing climate risks and opportunities. They will be updated every 5 years on the path to 2050.

We hear Victorians' calls for ambitious climate action. We are committed to continuously improving and adjusting over time as our communities, industries and governments work in partnership to build and maintain a climate-resilient Victoria.



The Hon. Lily D'Ambrosio MP  
Minister for Energy, Environment  
and Climate Change  
Minister for Solar Homes

# Contents

**Our commitment to  
adapt to climate change** 01

**Working towards a net-zero,  
climate-resilient Victoria** 03

**As our climate changes,  
we need to adapt** 04

**Adapting now creates  
economic opportunities  
and stronger communities** 07

**Adaptation Action Plans:  
A major step forward for  
climate resilience in Victoria** 13

Built Environment 15

Education and Training 19

Health and Human Services 22

Natural Environment 26

Primary Production 30

Transport 34

Water Cycle 38

**Climate resilience helps  
to secure Victoria's future** 41



# Working towards a net-zero, climate-resilient Victoria

## Our climate is changing

The most recent findings of the Intergovernmental Panel on Climate Change<sup>1</sup> demonstrate that the changes in the world's climate are widespread, rapid and intensifying. Human influence is contributing to many observed changes in extreme events, such as heatwaves and droughts. Some changes, such as sea-level rise, are already irreversible. Even if the world succeeds in limiting global warming to 1.5 degrees Celsius, some climate impacts will be with us for many decades to come.

Now is a critical moment for Victoria to respond to the risks and opportunities of climate change and to build resilience to the climate impacts we cannot avoid.

## Our framework for climate action is world-leading

Victoria's *Climate Change Act 2017* cements in law a commitment to achieve net-zero emissions by 2050 and establishes a 5-yearly framework for reducing emissions and adapting statewide systems to address the unavoidable impacts of climate change.

*Victoria's Climate Change Strategy* is a 5-year plan that:

- / outlines ambitious yet achievable emission reduction targets for 2025 and 2030 and the actions to achieve them
- / identifies Victoria's adaptation priorities for the next 5 years – addressing current climate change impacts, reducing barriers to adaptation, and laying the foundations for transformational adaptation so we are prepared for future climate scenarios.

## We're taking critical steps to adapt now

To achieve our adaptation priorities over the next 5 years and beyond, Victoria has a comprehensive, evidence-based approach centred around adaptation planning for statewide systems and complementary community-led action.

*Building Victoria's Climate Resilience* sets out how the Government is driving ambitious adaptation action by:

- / using the latest climate science
- / building on Victoria's track record of investment in adaptation
- / taking steps to ensure the social and economic opportunities of a climate-resilient Victoria benefit all people and communities across our state, now and into the future
- / implementing Adaptation Action Plans for 7 statewide systems that are vulnerable to climate change or vital to building our state's climate resilience.

# As our climate changes, we need to adapt

## Our state's climate has changed

Temperature **INCREASE** of 1.2°C since 1910



**DECREASE** in average rainfall



Significant **INCREASE** in fire danger in spring



## If global emissions continue to increase, in the 2050s Victoria may experience...

Average annual temperature **INCREASE** of up to 2.4°C



**DOUBLE** the number of very hot days



Sea levels **RISING** by around 24 cm



**LONGER** fire seasons, with up to double the number of high fire danger days



**DECLINE** in alpine snowfall of 35-75%



**DECLINE** in cool season rainfall



More **INTENSE** downpours



Under high emissions, compared to the period 1986–2005. Updated from *Victoria's Climate Science Report 2019*.

## We are using the latest climate science to guide our adaptation action

Victoria's climate has warmed by 1.2°C since records began in 1910. Our warmer and drier climate means more hot days and harsher fire seasons. There will be less overall rainfall and snow, but more intense rainfall events, increasing the risk of flash flooding in some locations.

With global warming set to continue until at least mid-century under all emissions scenarios, Victoria needs a robust foundation of science and research to guide our future climate action.<sup>2</sup>

The Victorian Government is investing in a climate science program and leveraging national research. *Victoria's Climate Science Report 2019* describes how our climate is changing and includes local-scale future climate projections for Victoria, developed with the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The next report is due in 2024.

The projections, supporting tools and guidance are informing decisions about adapting public health, urban planning, primary production, water, transport and energy infrastructure, and the protection of our ecosystems.



Interactive  
climate model  
simulations are  
available online  
via Victoria's  
Future Climate  
Tool



## We are building on a strong track record

### Adapting through our support programs, policies and services

#### \$384 million committed for **FOREST AND FIRE MANAGEMENT**

to protect our communities and environment and reduce bushfire risk in a changing climate<sup>3</sup>



#### \$10 million for **CLEAN ECONOMY WORKFORCE SKILLS**

that will support training for future jobs in building Victoria's climate resilience<sup>6</sup>



#### Over \$37 million for community-centred forest management and **SUPPORTING TRADITIONAL OWNERS** to manage Country<sup>4</sup>



#### **MAJOR WATER MANAGEMENT REFORMS**

across Victoria to respond to the historic Millennium Drought (1996–2010)<sup>5</sup>



#### A comprehensive **MARINE AND COASTAL POLICY** to support a healthy, dynamic and biodiverse marine and coastal environment<sup>7</sup>



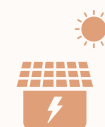
#### Delivering innovative **DISASTER RESILIENCE EDUCATION** for students in schools vulnerable to fire, floods or storms<sup>8</sup>



### Building the resilience of our assets and operations

#### \$797 million for Victoria's **HOUSEHOLD ENERGY SAVINGS PACKAGE**

to help Victorians reduce their power bills and make homes more energy efficient<sup>9</sup>



#### Over \$11 million to **PROTECT VICTORIA'S COASTLINE**

through projects tackling rising sea levels and coastal erosion<sup>10</sup>



#### An additional \$10.4 million to complete the Macalister **IRRIGATION DISTRICT MODERNISATION**

to save water, reduce runoff and improve water quality<sup>11</sup>



#### \$133.5 million for **BETTER COMMUNICATIONS DURING EMERGENCIES**

through upgraded digital radios for forest and fire management staff and volunteers<sup>12</sup>



#### Expansion of the **POWERLINE BUSHFIRE SAFETY PROGRAM**<sup>13</sup>

to make powerlines safer – with 736km of overhead powerlines already replaced in high-risk bushfire areas<sup>14</sup>





# Adapting now creates economic opportunities and stronger communities

## Protecting our health and our economy

Prioritising climate resilience now makes economic sense and is vital for Victoria to remain one of the most liveable places in the world.<sup>15</sup>

For example, increasingly severe and longer lasting bushfire seasons may create poor air quality and respiratory problems for many people, while endangering critical ecosystems and infrastructure. Heatwaves are the leading cause of weather-related deaths in Australia and will increasingly threaten worker safety and productivity in weather-exposed industries.

Taking steps now to build our resilience reduces the impacts on the health of people and ecosystems and minimises economic disruption. It also protects Victoria as a destination for investment, employment and tourism.

Ambitious adaptation efforts taken today can help to prevent future disruptions and job losses in industries that are central to our state's economy, such as tourism and primary production.

**It is estimated that every \$1 spent on adapting to climate change now saves society an average of \$6 in future costs.<sup>17</sup>**



## Tourism

Improving the climate resilience of Victoria's precious coastal assets, transport infrastructure and agricultural regions helps protect our tourism industry which employs more than 230,000 people and contributes \$26.7 billion to our economy.<sup>16</sup>

## Primary industries

Victoria accounts for over 28% of Australia's food and fibre exports and is on track to reach its \$20 billion export target by 2030.

To manage climate impacts on agricultural productivity, Victoria must identify climate risks to production and supply chains, and support primary industries to diversify and maximise opportunities from the changing climate.

## We are investing in adaptation to reduce costs and ensure Victoria's prosperity

### The costs of not adapting to climate change are too high

Failing to prepare for the worsening impacts of climate change means falling behind. Victoria cannot afford to delay action now and pay the price later.

If emissions continue to grow at the rate seen in recent decades and no adaptation action is taken, the estimated costs of damage from climate change in Victoria would be over \$150 billion by 2050, escalating to about \$1 trillion by 2100.<sup>18</sup> These estimates likely understate the full financial impacts, as they do not include most of the costs of floods, bushfires, pollution and biodiversity loss.

### The global economic and financial signals to adapt are growing

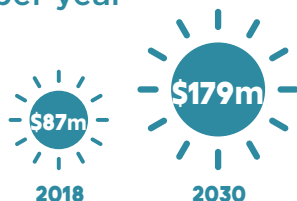
Institutional financiers and insurers are prioritising investment in the regions, industries and companies that are actively managing climate risk.<sup>19</sup> International ratings agencies also include climate-related factors in evaluating governments' creditworthiness.<sup>20</sup> Failing to take early adaptation action increases the risk that more private and commercial properties may be uninsurable from future impacts like bushfires and sea-level rise.

Investing in adaptation now also positions Victoria to lead and benefit from emerging solutions – such as new construction and manufacturing technologies and methods – that will be increasingly needed to ensure the climate resilience of our critical infrastructure and services. By moving early to confront the challenges ahead, we can seize on opportunities.

Sea-level rise of 80 cm by 2100 could put at least an estimated \$18.3b worth of Victoria's coastal infrastructure and assets at risk of inundation and erosion<sup>21</sup>



Heatwave events already cost Victoria on average \$87m each year. By 2030, they are predicted to cost the Victorian economy \$179m per year<sup>22</sup>





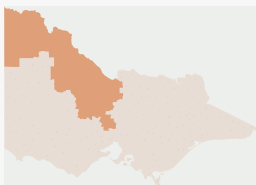
## We are investing in adaptation so communities can thrive

### Supporting communities to take local action

People across Victoria are concerned about the climate impacts they are already experiencing and want everyone – business and industry, local government, environment groups and individuals – to play their part.<sup>23</sup> More than 8,000 people contributed to the development of 6 community-owned Regional Adaptation Strategies to guide local action over the next 5 years.

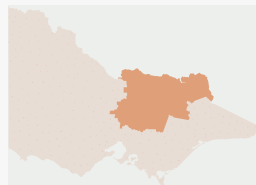
#### LODDON MALLEE

The region's highest earning industries are manufacturing and agriculture, and its projected population growth is higher than the Victorian average. Loddon Mallee is home to Victoria's highest proportion of Aboriginal people and over 8,000 Aboriginal places of cultural significance. Its Strategy focuses on ensuring climate ready people, places and sectors.



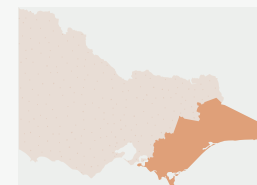
#### HUME

Agriculture, forestry and fishing are Hume's biggest earning industries, while hospitality and tourism are its largest employers. Its Strategy focuses on emergency management, the natural environment, renewable energy, health and wellbeing, the built environment, and the economy and workforce.



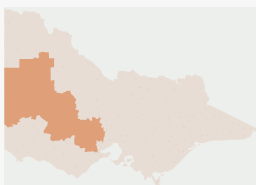
#### GIPPSLAND

The region contributes a high share of Victoria's gross regional product (\$15.4 billion in 2015). The vision of Gippsland's Strategy is for Gippslanders to be aware of climate change impacts on community and Country, be flexible to adapt, and be supported in adapting to climate change.



#### GRAMPIANS

Ballarat is the largest regional centre in the Grampians region. Agriculture accounts for the majority of land use in the region, which is known for its diverse geography and many tourist destinations. The Grampians Strategy focuses on 8 interconnected themes: agriculture, biodiversity, economy, fire, health and wellbeing, heat, storms and flooding, and water.



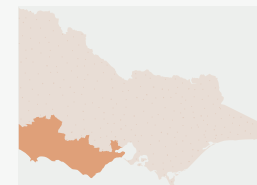
#### GREATER MELBOURNE

The region is home to around 5 million people – three-quarters of Victoria's population – and over 200 languages are spoken across the region. The region's Strategy takes a systems approach to 12 action areas. Its vision is for the region and its communities to have the agency, will, skills and resources to adapt to climate change.



#### BARWON SOUTH WEST

The region accounts for a quarter of Australia's dairy production. While its population has grown in areas like Torquay, populations are shrinking in traditional agricultural areas. The region's Strategy has 12 comprehensive focus areas and its principles for collaboration are inclusion, equity, use of the best available information and tools, and deliberative learning.



## Ensuring no one is left behind

For some people, climate change is an additional pressure on top of existing vulnerabilities and challenges.<sup>24</sup> For example, more intense and longer lasting hot weather poses bigger risks to the health of older people, young children and pregnant women. Heat stress also disproportionately affects people with disabilities.

Often, the people who are more vulnerable are also the least equipped to adapt to climate change. The costs of adapting – such as to retrofit homes to be cooler in summer or to repair them after storms or floods – can be prohibitive for people on low incomes, who may also be unable to afford insurance.

Building climate resilience means accounting for these varied impacts and ensuring vulnerable people are at the forefront of decision making.

The Victorian Government is committed to including diverse perspectives, partnering with local government and helping to create stronger communities by supporting Victorians to build resilience to climate change.





## Supporting Traditional Owner self-determination and care for Country

Traditional Owners have protected and cared for Country since the Dreaming. However, due to colonisation, they have experienced dislocation and dispossession from their rights and rites to Country.

Given Australia's history of dispossession, the Victorian Government has an obligation – on behalf of the people of Victoria – to work in partnership with Traditional Owners and Aboriginal Victorians to support their right to self-determination. Treaty and the Yoo-rrook Justice Commission are key steps towards advancing self-determination, healing and supporting Traditional Owners' rights on Country.

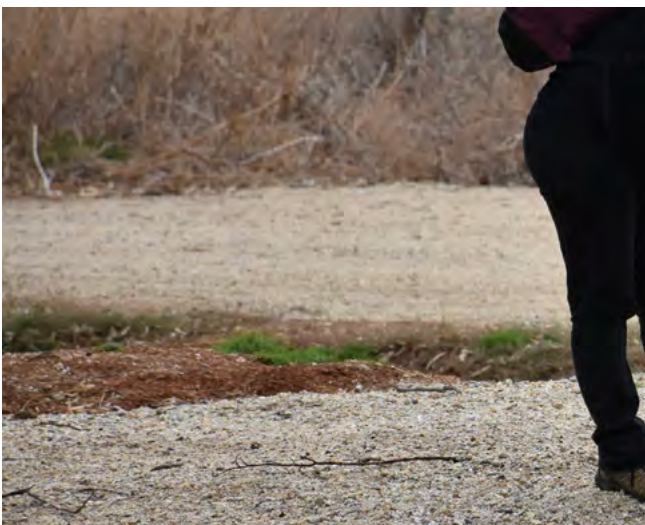
Victorian Traditional Owners have developed the Cultural Landscapes Strategy to provide direction to the Victorian Government about how it can enable and empower Traditional Owner self-determination in land management.

The Cultural Landscapes Strategy sets out a framework and pathways to lead the planning and management of Country in line with cultural obligations to care for Country. This is further supported by the strategic commitments of the Victorian Government Department of Environment, Land, Water and Planning (DELWP) to enable self-determination and the rights of Traditional Owners, listed under the Country domain of *Pupangarli Marnmarnepu* 'Owning

*Our Future*' Aboriginal Self-Determination Reform Strategy 2020–2025.

The Victorian Government is proud to work with Traditional Owners to better care for Country through various initiatives. This has included facilitating the re-introduction of cultural burning and the introduction of the landmark Wilip-gin Birrarung murrn (Yarra River Protection Act), which enshrines in law the protection of the Yarra River corridor and acknowledges the significance of the river to the Wurundjeri People and their ongoing role in its management.

Climate change has a unique impact on Aboriginal people, especially when it comes to seasonal management and spiritual connections with Country.



Climate change poses an additional threat to cultural values and sites, beyond the legacy of colonisation.

The Victorian Government will continue partnering with Traditional Owners and Aboriginal Victorians to ensure their cultural, ecological and economic values and expertise are integrated into climate change adaptation planning. This is one of the Government's 5-year adaptation priorities outlined in *Victoria's Climate Change Strategy*, and aligns with DELWP's support of self-determination by creating an environment that understands and respects the rights and interests of Aboriginal Victorians.





#### CASE STUDY

### Partnering with Dja Dja Wurrung to advance self-determination and climate change adaptation

The Victorian Government has partnered with the Dja Dja Wurrung Nations to build knowledge about how climate change impacts cultural values associated with water and identify opportunities to adapt.

Dja Dja Wurrung has developed a climate change cultural water values framework (renamed Bundjil's Law) as part of the *Pilot Water Sector Climate Change Adaptation Action Plan 2018-2020*, funded by the Victorian Government. The framework outlines Dja Dja Wurrung Cultural Water Values and highlights how Dja Dja Wurrung world views and connection to Country need to inform climate change adaptation. The framework is a cross-cultural tool to support the Dja Dja Wurrung and government water managers to work in partnership on ensuring climate change adaptation initiatives align with Dja Dja Wurrung rights, obligations and Country objectives.

Lessons from this project will be shared with Traditional Owner groups and government agencies to build overall cross-cultural capacity and better protect and embed Traditional Owner knowledge, governance and rights into climate change adaptation policy and planning, including across the 7 Adaptation Action Plans.





# Adaptation Action Plans: A major step forward for climate resilience in Victoria



## We are driving vital adaptation action across 7 essential systems

Victoria's Adaptation Action Plans are guiding government action and helping institutions, businesses and individuals take informed action to respond to the risks and opportunities of our changing climate.

The plans reflect lessons learned from adaptation efforts to date and have been informed by organisations and experts as well as the public through consultation in mid-2021.

Each plan sets out:

- / the challenges of climate change for each system
- / the extensive work already underway
- / the key priorities for the next 5 years.

### BUILT ENVIRONMENT



### EDUCATION AND TRAINING



### HEALTH AND HUMAN SERVICES



### NATURAL ENVIRONMENT



### PRIMARY PRODUCTION



### TRANSPORT



### WATER CYCLE







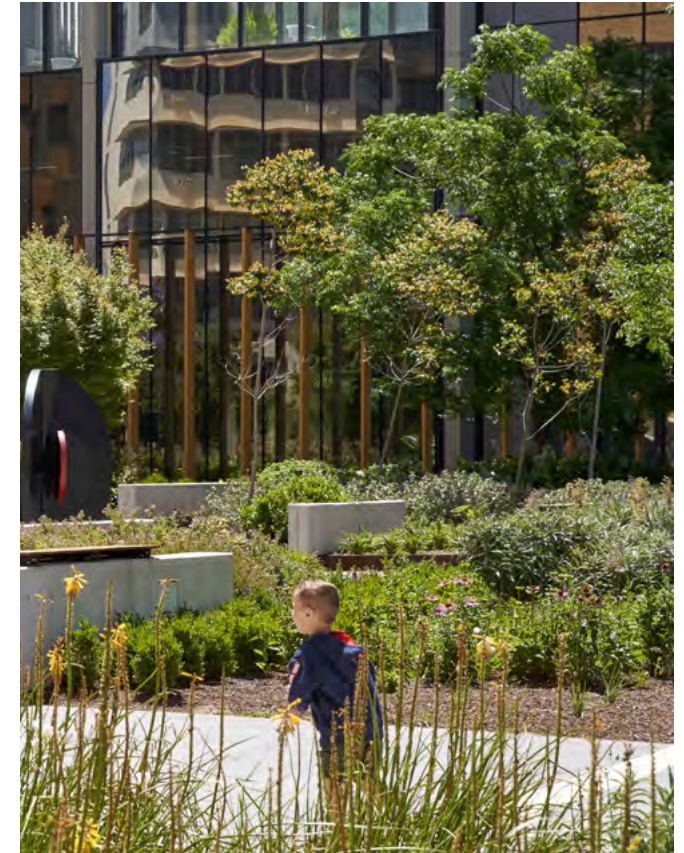
# Built Environment

## The challenge

Climate change threatens the built environment – the places we have built to use and enjoy in our everyday lives. This includes physical structures and assets (such as homes, other buildings and infrastructure, including energy infrastructure and systems), built and natural assets (such as cultural heritage places, public parks and sports fields), and how people interact with them via different activities and services.

Across Victoria, our built environment faces potential risks from bushfires, heat, flash flooding and coastal inundation, which can:

- / endanger people's health and safety and increase the incidence of death, injury or disease, such as heat stress during heatwaves and respiratory illness due to bushfires
- / disrupt business, services and everyday community activities
- / incur major repair costs for buildings and infrastructure
- / increase hazard exposure and investment uncertainty, affecting the vitality and growth of our cities, towns, suburbs and regional areas.







## Work already underway

**Introducing minimum standards for around 320,000 rented homes' energy efficiency,** to improve renters' comfort and reduce their energy costs.<sup>25</sup>

**Requiring planning schemes** to respond to potential coastal impacts and sea level rise.

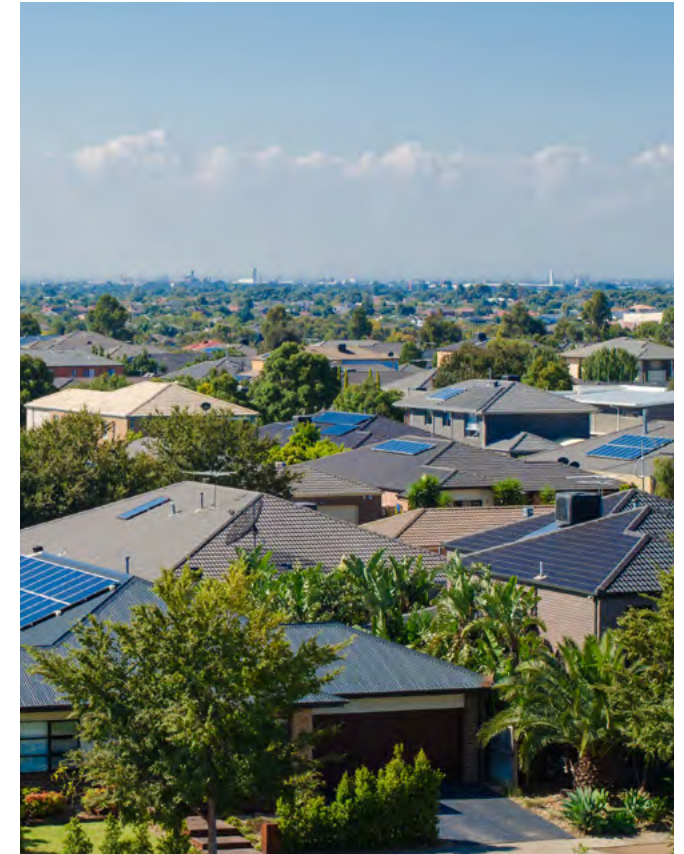
**Mapping coastal inundation hazards** is underway or completed for many coastal areas.

**Providing guidance** for development in flood-affected areas.

**Mapping heat vulnerability in Melbourne** and preparing advice for cooling our homes and streets.

**Improving planning and building system responses to bushfire risk**, for example, by reforming plans to prioritise safety and continuing to direct growth to lower-risk parts of Victoria.

**Building energy infrastructure resilience**, from upgrading powerlines to reduce bushfire risks to supporting microgrids, batteries and community renewable energy projects in isolated areas.





## Key priorities ahead

The next 5 years (2022–2026) will be focused on improving essential policies and standards to make our built environment more climate-resilient, particularly for highly exposed and vulnerable Victorians.

**Updating building standards** to better account for projected impacts such as floods, heatwaves, bushfires and storms.

**Pursuing further upgrades to existing buildings**, focusing on improvements such as better insulation and more efficient heating and cooling for low-income and vulnerable Victorians.

**Partnering with social services, government agencies and people** who have lived through extreme events to identify support measures for vulnerable and highly exposed communities to adapt.

**Examining options to improve energy infrastructure resilience**, including reviewing the adequacy and robustness of existing frameworks to address increasingly frequent and intense storms.

**Continuing to support hazard-exposed communities** in developing place-based resilient energy generation, including through temporary relief measures such as generator provision.

**Upskilling and training for community leaders and industry professionals** to lead community resilience planning and make homes, commercial buildings and essential services more resilient.

**Supporting highly exposed regional cities and towns** to tackle overlapping climate-related events through resilience and recovery planning that considers all hazards.

**Expanding spatial mapping and hazard exposure modelling** to improve decisions on land use and infrastructure planning and investment.





## CASE STUDY

### Planting trees for a cooler, greener Melbourne

The Victorian Government is investing \$5 million to plant both mature and young trees across Melbourne's west to help adapt to climate change by providing more shade and green spaces.<sup>26</sup>

Heat extremes during warmer months are made worse in our urban areas due to reduced vegetation cover and the prevalence of hard materials and dark surfaces that absorb heat. This poses significant threats to the health and wellbeing of people, pets and native wildlife. Urban heat is an increasing threat to cities' liveability and productivity, made worse by more frequent and extreme heat days and heatwaves caused by climate change.

Melbourne's western suburbs experience some of the highest levels of urban heat vulnerability in metropolitan Melbourne. In 2018, Melbourne's west had just 5.5% canopy cover in urban areas, compared to 17.4% in the inner south-east and 25.9% in the east.

Planting trees to increase shade and cooling through urban forest and canopy cover can reduce air temperatures across a precinct by up to 2°C, helping to reduce heat-related illness and death, and giving people better access to cooler green spaces.



Temperature reductions directly under a canopy tree are greater (around 4°C lower). Tree-planting also benefits biodiversity by introducing varied tree sizes and species and strengthening wildlife corridors. Trees can also help improve air quality by filtering pollutants and support better stormwater management through increased infiltration and reduced runoff.







# Education and Training

## The challenge

The Education and Training system includes the people, places and services involved in life-long learning. It serves at least one-third of Victorians every year across the early childhood, school, higher education, and training and skills sectors.

The Education and Training system is already affected by extreme weather events, and rising temperatures will challenge the system's workforce, learners, services and built assets. Key risks include threats to the health and safety of students and staff, damage and increased maintenance and recovery costs to schools and facilities, and disruptions to service provision and learning.

The system is also central to supporting Victorians to learn about climate change and how we can build our climate resilience. Climate change is a major concern for young people – it is affecting some young Victorians' mental wellbeing, and children are especially vulnerable to climate impacts. Children in their early years of school have never experienced a below-average year in temperature – every year from 2013 to 2020 has ranked among the warmest years since Australian records began in 1910.<sup>27</sup>





## Work already underway

**Partnering with state, regional and local emergency management** to comprehensively manage risks, prepare and plan, respond to and recover from extreme events.

**Providing heat health alerts, advice and wellbeing guidance** for schools to respond to extreme hot weather, heatwave events<sup>28</sup> and bushfires.<sup>29</sup>

**Requiring all schools to comply with Victoria's bushfire preparedness guidelines<sup>30</sup>** and requiring registered Bushfire At-Risk schools and early childhood services to pre-emptively close on days declared as 'Code Red' in their districts.<sup>31</sup>

**Supporting education and training providers** to incorporate climate change into teaching and learning.

**Delivering facilitated workshops** and developing e-learning modules to provide school leaders with emergency management information and guidance.

**Integrating environmental sustainability** as a priority outcome in early childhood education, as a cross-curriculum priority in the Victorian curriculum, and in whole-school action through programs such as ResourceSmart Schools.







## Key priorities ahead

The next 5 years (2022–2026) will be focused on ensuring that decision makers, educators and learners have the information, tools and capacity to respond to current and future climate impacts, particularly those related to health and wellbeing, and infrastructure and assets.

**Improving educators' and learners' ability** to understand climate risk and embed adaptation in their everyday decisions.

**Identifying climate risks to the school asset portfolio** and integrating adaptation into Victorian School Building Authority policies.

**Investigating how the early childhood education sector can be supported** to build the climate resilience of early learning and kindergarten infrastructure and operations.

**Preparing a plan to address thermal comfort-related climate change impacts** in Victorian Government schools.

**Making assets more resilient** by incorporating locally tailored training and resources (such as flood overlays and temperature and rainfall projections) into land use planning, site selection for education services, and capital works.

**Working with adult, community and further education providers** to identify climate change-related learning barriers and build adaptation knowledge and skills.

**Identifying good practice climate change education** and convening diverse groups of students to advise on the learning and resources they find most engaging.

**Consulting with industry on climate impacts** to inform recommendations to enable the incorporation of climate change adaptation into vocational training.







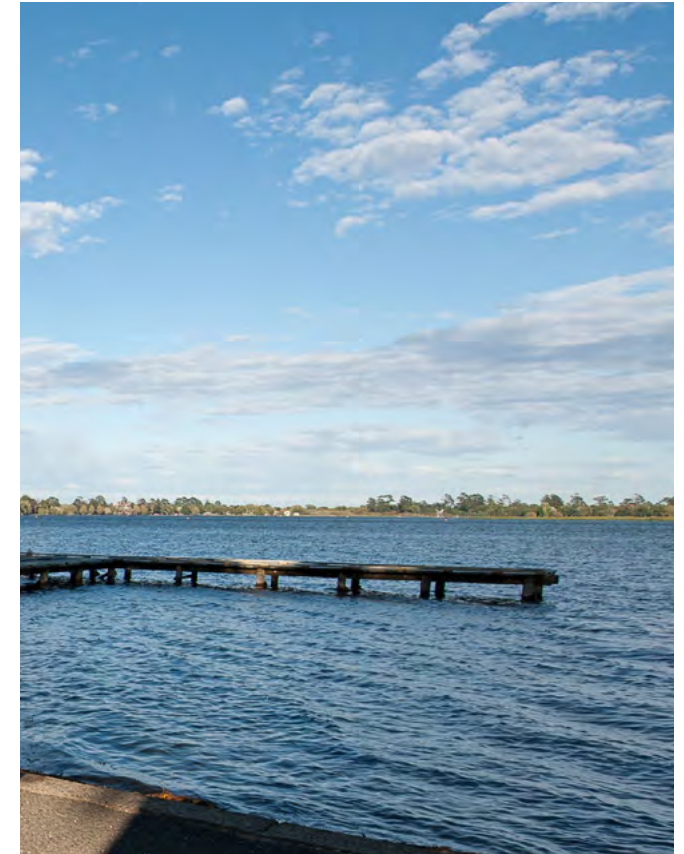
# Health and Human Services

## The challenge

The World Health Organization describes climate change as the greatest threat to global health this century.<sup>32</sup>

Climate change is already affecting health and human services in Victoria, which include public health and wellbeing services and assets, social housing infrastructure, and support for vulnerable community members. The system is central to life across our state – more Victorian residents work in healthcare and social services than any other industry. The Victorian Government manages more than \$23 billion in health assets and more than \$26 billion in public housing assets.

Victoria's warmer temperatures are increasing the vulnerability of the system's workforce, services and built assets to a wide range of risks. More frequent and intense extreme weather events, such as floods, bushfires, storms and heatwaves, directly threaten individual and community health and wellbeing. Impacts can include heat stress, respiratory and cardiovascular illness, mental illness, disease transmission, injury and death.





## Work already underway

**Supporting state and municipal public health and wellbeing planning** to tackle climate change and its impacts on health.

**Establishing updated engineering and sustainability guidelines** to ensure health infrastructure is climate-resilient – for example, requiring health facilities in bushfire-prone areas to have additional energy generation capacity and fuel storage in remote areas.

**Constructing new social housing** to support climate resilience through higher levels of thermal performance.

**Supporting the installation of energy efficient appliances and thermal shell upgrades** to existing public dwellings to increase residents' comfort and safety in their homes.

**Partnering with Victorian disability advocacy organisations** to design inclusive emergency management planning approaches.

**Embedding climate risk responses** in policies, procedures and capital investment decisions for assets such as hospitals, health services and housing.

**Identifying ways to integrate climate change** into existing efforts to build on past lessons on trauma-informed disaster recovery and into applicable recommendations from the Royal Commission into Victoria's Mental Health System.







## Key priorities ahead

The next 5 years (2022–2026) will be focused on increasing public engagement on climate resilience and health, improving the climate resilience of infrastructure, and improving system-wide capacity to prepare for and respond to climate change.

**Investing in better monitoring and a more robust evidence base** on climate-related health impacts in Victoria, including ongoing surveillance to gather data on changes in climate-related hazards and population health outcomes, and to enable reporting on changes in demand for health services due to climate change.

**Investing \$112 million** to improve the energy efficiency of 35,000 social housing properties, to reduce the impact of heatwaves in summer and save residents money on energy bills.

**Embedding Aboriginal self-determination in adaptation activities** by prioritising Aboriginal Elders and community voices and centring Aboriginal knowledge and culture in adaptation responses.

**Reducing social housing exposure** to climate-related risks and natural hazards by actively managing high-risk housing stock.

**Specifying climate resilience in new social housing** developments, while upgrading existing social housing to transform the current asset base.

**Providing best practice examples and technical advice** for making new and existing health infrastructure climate-resilient.

**Developing tailored mental health and wellbeing support** to help the Victorian community respond to climate change impacts.



**Promoting climate training, tools and risk management resources** for health and human services professionals, including those in the community service sector and smaller funded organisations (including Aboriginal Community Controlled Organisations).

**Elevating the Chief Health Officer and other health professionals' leadership roles** in engaging on climate and health across the system and with communities and other sectors.





#### CASE STUDY

### Research on the disproportionate impact of emergencies on people with disabilities

Emergencies such as those caused by extreme weather events can have disproportionate impacts on people with disabilities, placing them at higher risk of death, injury and loss of property. Ensuring that people with disabilities are prioritised in emergency management planning and decision making is critical to taking a fair and inclusive approach to climate change adaptation.

The Department of Families, Fairness and Housing has engaged the University of Sydney to partner with Victorian disability advocacy organisations to design an inclusive approach to emergency management planning in Victoria. The project is currently underway and aims to build capacity in the disability, community and emergency services sectors to work together to increase the resilience of people with disabilities, through peer-support advocacy and inclusive local emergency management planning.

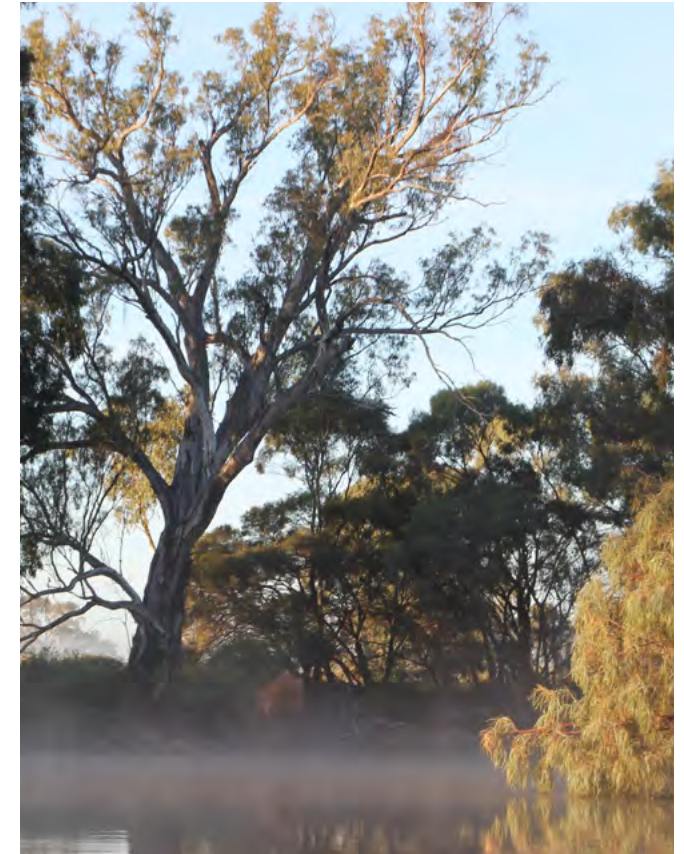
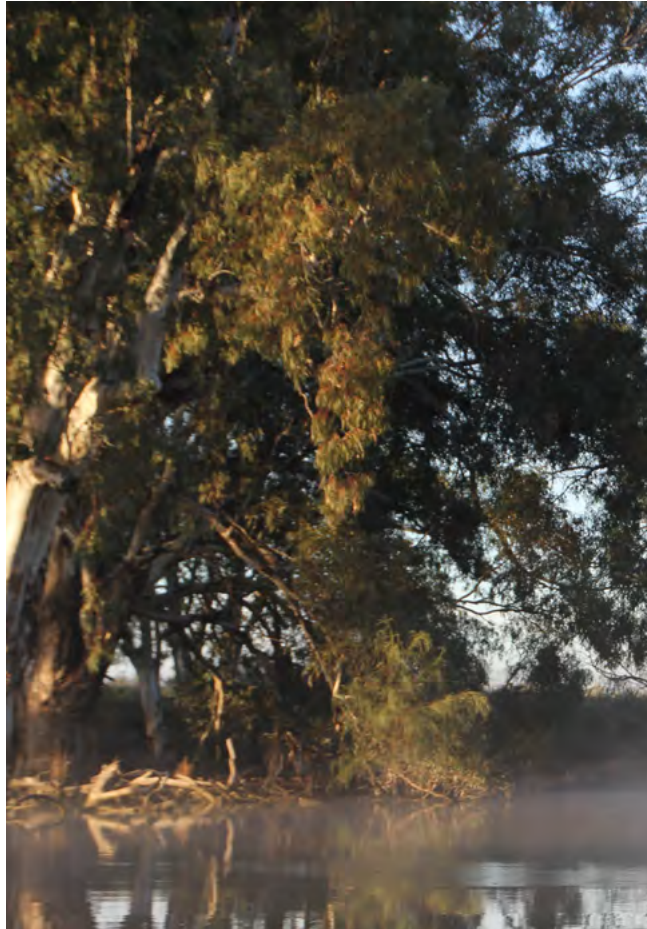




# Natural Environment

## The challenge

Victoria's natural environment includes land-based ecosystems such as grasslands and forests, aquatic ecosystems such as rivers and wetlands, and coastal and marine ecosystems such as mangroves and sea-grass meadows. These ecosystems have immeasurable intrinsic value. They support life and provide some of our most basic needs, like clean water, productive soil, natural pest control, pollination, flood mitigation and carbon sequestration. Replacing the services that ecosystems provide would be extremely challenging and costly, if not impossible. Maintaining our natural environment for future generations is vital insurance in the face of ongoing change.







The effects of climate change already unfolding in Victoria – particularly more frequent fires, more intense droughts, reduced snowfall and increasing marine temperatures – are expected to worsen over time. These worsening impacts will increase the risk of habitat loss, species extinction and major ecosystem change.

Climate change also affects Aboriginal culture and practices, including through loss of land and hunting grounds, changing fire regimes, and fewer animals in creeks and the sea.

Climate impacts can occur suddenly and cause large environmental shifts, including the collapse of ecosystems. This not only requires us to build natural ecosystems' resilience but also consider options where impacts are significant or if the future is worse than anticipated. We need to identify potential tipping points and work to minimise consequences for our society and environment. We must ensure our decision making methods are adaptive and flexible to accommodate uncertainty and changes in knowledge.

## Work already underway

**Responding swiftly to the 2019–20 bushfires** by coordinating recovery and protecting biodiversity through:

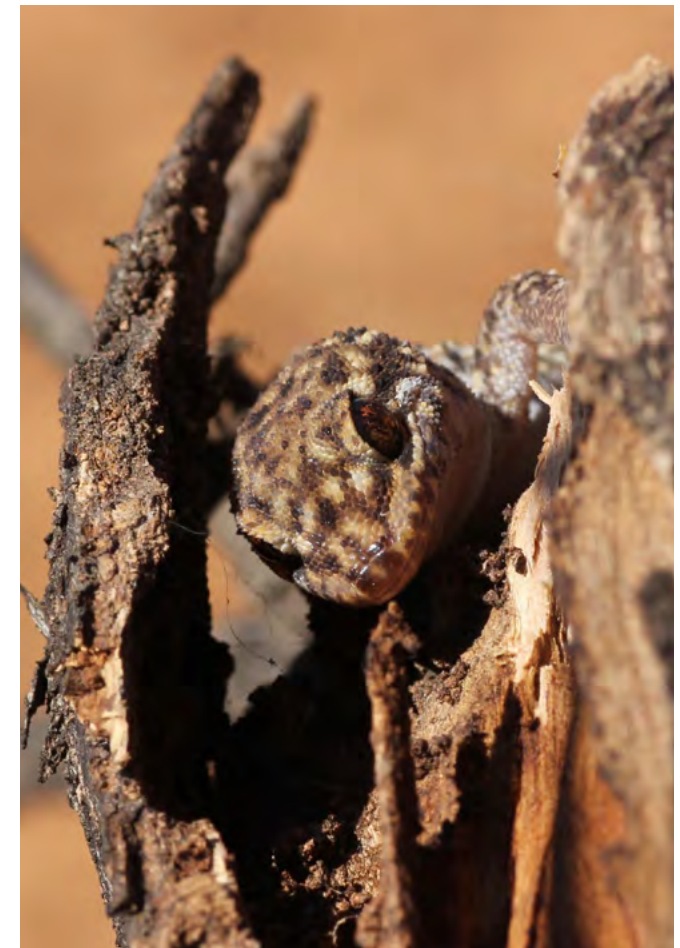
- / ground and aerial surveys to assess specific fire impacts
- / emergency extraction of critically threatened animals and plants
- / protecting ecological refuges, revegetation and reseedling.<sup>33</sup>

**Supporting Traditional Owners** to apply their ecological knowledge and lead cultural heritage and related activities in areas affected by the 2019–20 bushfires.

**Looking beyond single fire events to consider long-term strategies** for maximising ecosystem resilience throughout Victoria and identifying priorities for reducing future fire risk to biodiversity.

**Providing grants to support fire-affected communities** to learn about nature's response and design and deliver projects that benefit local plants, wildlife and habitats.

**Using the adaptation pathways approach** in Victoria's Resilient Coast project.





## Key priorities ahead

The next 5 years (2022–2026) will be focused on building the foundations of the practices, systems, and knowledge that will enable effective adaptation to climate impacts on Victoria's natural environments. The plan will embed climate change adaptation into natural environment management by guiding adaptation planning in regional and place-based plans that manage specific areas and ecosystems, species and natural environment values.

**Assisting regional fire planners** to include the climate adaptation lens in bushfire recovery planning.

**Including future weather scenarios** in bushfire and forest modelling and planning.

**Creating a framework for monitoring and assessing** emerging threats.

**Preparing a foundational guide to transformational adaptation** in the natural environment.

**Identifying parts of Victoria** that may be more vulnerable to climate impacts.

**Exploring opportunities to support behaviour change initiatives** and build community understanding of and action for climate change adaptation.

**Considering the climate adaptation lens** in the whole-of-sector bushfire management strategy and renewal of the Victorian Waterway Management Strategy.

**Supporting Traditional Owner outcomes and objectives**, and prioritising self-determination in building the climate resilience of the Natural Environment system.





## CASE STUDY

### Responding to bushfires

Victoria is facing longer fire seasons, with up to double the number of high fire danger days. The 2019–20 bushfires resulted in a tragic loss of life and the devastation of wildlife and forests. More than 1.5 million hectares of Victorian land were burned and close to 400 homes destroyed.<sup>34</sup>

The air quality in many parts of Victoria became the worst in the world due to smoke haze.

Health services, water supply, roads and electricity infrastructure were disrupted. This affected businesses and community facilities, including schools.

### Tackling the economic impacts

The bushfires cost the Victorian economy \$2.1 billion. Around 70% of the total economic impacts have been attributed to the suppression of international tourism in Victoria over the coming years. The accommodation, food services, transport and construction sectors have been especially hard-hit.

The Victorian Government invested \$250 million towards affected communities.<sup>35</sup> This included establishing Bushfire Recovery Victoria to coordinate effective, timely support to help communities recover after major emergencies. The agency is now administering the clean up and recovery program.

Financial support and relief programs were delivered for people and businesses after the bushfires to boost economic recovery and cushion employment losses in affected regions and industries.



### Leveraging Victorian expertise in managing bushfires

Australia is recognised as a world leader in the science behind bushfire behaviour.<sup>36</sup>

The PHOENIX RapidFire bushfire simulator was developed in Victoria and is used by land and fire managers to support fire management and decision making during bushfires.<sup>37</sup>

Fuel management strategies are being delivered to reduce the risk of bushfires to communities through planned burning, slashing and mulching.

As climate change increases the hotter temperatures and drier conditions that contribute to bushfires, further research will ensure that climate scenarios are taken into account in the prediction and management of bushfire risk.





# Primary Production

## The challenge

Victoria's primary industries are major export and wealth generators. They employ more than 190,000 people with over 80% of them in regional Victoria. The Primary Production system includes agriculture, plantation forestry, productive fisheries and the infrastructure, workforce and communities supporting them. It covers the full value chain: key inputs, growth and harvest, production and processing – everything that gets products to market.

As a result of climate change, Victoria is likely to become hotter and drier and experience increasingly frequent and extreme events such as heatwaves, bushfires and droughts. The availability of fresh water is likely to become more critical. These impacts are expected to affect access to key inputs, services and markets and lead to shifts in growing conditions and seasons. They could also increase the risk of negative impacts on worker health and animal welfare, increase pest and disease outbreaks, and reduce the availability of finance and insurance.







Adapting to climate change will also create opportunities. Bringing new products to market, generating efficiencies and diversifying production, land use and income streams will support business continuity and growth. By 2040, our primary industries need to be moving toward long-term transitions – continuing to respond to the changing climate and showing strong adaptive capacity.

## Work already underway

### Implementing policies and strategies

(such as Victoria's Agriculture Strategy) that support thriving primary industries to better manage climate risks and opportunities.

### Collaborating with commercial fishers

to improve reef kelp and algal habitats and food sources for fish.

### Supporting sustainable land management

and farm planning services for irrigation and dryland regions.

**Investing in new technology** such as solar photovoltaics and improved irrigation systems to increase water and energy efficiency, reduce costs and build climate resilience.

**Developing and delivering information and tools** with farmers including seasonal forecasts and soil-moisture and land-health monitoring for informed decision making.

**Providing agriculture extension services** including resources and staff support and advice for regional and industry adaptation.

**Testing and demonstrating new technologies** for farmers to showcase options to become more climate-resilient, increase productivity, improve livestock welfare and reduce emissions.



**Investing in native fish** hatcheries, fish stocking programs, fisheries monitoring, and facilitating new aquaculture industries.

**Investing in the establishment of new plantations** to support the long-term sustainability of Victoria's timber harvesting industry.





## Key priorities ahead

The next 5 years (2022–2026) will be focused on building the climate resilience of value chains, facilitating research and innovation, and supporting primary industries to build further on their climate change adaptation information, skills and capacity.

**Exploring ways to reduce climate change risks** to key inputs and supports to the primary industries, such as water, energy, telecommunications, credit and insurance.

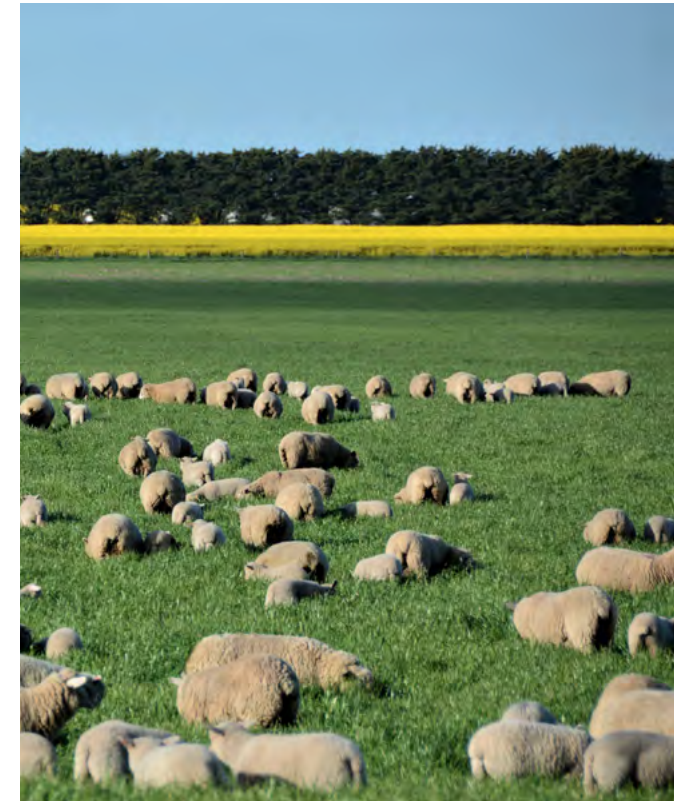
**Collaborating with health and community services** to assess climate change-related health risks to primary industries workers and communities, and food safety issues for consumers.

**Investing in cross-disciplinary research,** monitoring, trials, modelling and decision-ready information to improve understanding of climate change impacts and adaptation options for primary industries.

**Researching common issues, adaptation options and co-benefits** for the interconnected Primary Production, Water Cycle and Natural Environment systems.

**Working with primary industries,** both regionally and industry-wide, to support outreach and professional development to strengthen their adaptation skills and capacity. This includes efforts to support improved efficiencies and productivity, new technology and income diversification.

**Strengthening our knowledge** of how emergency responses and recovery funds can support primary industries' climate resilience.





## CASE STUDY

### **A changing climate opens market opportunities for Victorian primary producers**

Shifts in water availability and temperatures on land, and changing currents, chemistry and temperatures in our marine environment, will alter which fish are grown where and which species we harvest in our oceans. These changes may allow the targeting of new productive fish species in Victoria's marine waters and create conditions for new aquaculture markets to develop, offering new opportunities to meet demand for alternative proteins.

Victorian farmers in the Wimmera and Southern Mallee region are thinking of ways to stay productive and sustainable while facing the challenges of extreme events and less rainfall. International and domestic markets are boosting opportunities for Australian pulses – such as lentils, faba beans and chickpeas – driven by rising demand for plant-based proteins and growing awareness of health and wellbeing, animal welfare and environmental concerns. In Horsham, recent investments in the manufacture of plant-based protein will provide a potential new high-value avenue for pulses, which are sold as bulk commodities and routinely grown for disease control and soil quality improvement.

The Grains Research and Development Corporation and Agriculture Victoria is exploring innovative technologies and tools at the Horsham Grains Innovation Park to ensure research outputs are quickly adopted, helping plant breeders increase yields in different regions and adapt to the changing climate.





# Transport

## The challenge

The Transport system includes transport users, freight services, transport networks, facilities, systems and vehicles, and the people that plan, design, operate and manage them. Climate change has the potential to affect all aspects of transport operations, maintenance and construction, including:

- / harm to assets
- / disrupted services, operations, maintenance and construction
- / disrupted access
- / discomfort to transport staff and users
- / increased public safety hazards.







The transport network is a key part of Victoria's critical infrastructure. Roads, bridges and ports play a central role in facilitating access and egress during emergency events such as fires and floods. Climate-related road and rail incidents cost VicRoads and Public Transport Victoria about \$220 million (including insurance claims) from 2004-2020. Flood damage, especially from 2011 flooding, accounted for about 80% (\$176 million) of the total cost, with bushfire-related costs making up about 17% and landslides, storms and wind about 3%.

Climate-related events already incur major Transport system costs and maintenance requirements, and these are expected to grow in the future. The Transport system's emergency planning, preparedness, response and recovery approaches need to address critical risks to transport users, infrastructure and assets from fires, floods, heat and other events. Transport infrastructure must be robust to avoid, withstand and recover from climate change impacts while continuing to provide essential services and support community wellbeing.

## Work already underway

Current challenges are already being addressed. For more than 10 years, Victorian Government transport agencies have had policies that consider long-term climate change in the planning, design, construction, and operation of transport infrastructure. The Transport Adaptation Action Plan builds on these policies, including to:

### Design transport assets to be resilient

to potential risks and degradation, including from climate change impacts.

### Apply climate change adaptation

**standards** for transport asset planning, design, construction, operations and maintenance.



**Review emergency management plans** to guide future preparedness, response and recovery of transport assets and services following extreme events.

**Prioritise asset management according to key service factors**, such as their importance, monetary value, community value and levels of use.

**Factor climate change impacts** into port operations, maintenance and long-term planning.

**Build climate scenarios** into transport project flood and drainage models, standards and design outputs.

**Support passenger safety and wellbeing** during heatwaves by ensuring access to drinking water and health infrastructure (such as defibrillators) at selected transport hubs.





## Key priorities ahead

The next 5 years (2022–2026) will be focused on establishing a solid foundation for building the Transport system's climate resilience, by improving knowledge, capacity and decision making approaches.

**Strategically manage and invest in transport infrastructure** that is at high risk of frequent and severe climate-related impacts.

**Build on lessons from the 2019–20 bushfires** – for example, assess local bridge and road suitability for emergency events and evacuations, and review single-road access to remote towns.

**Partner with transport agencies and industry** to help the Transport system recover faster from climate-related events through better informed emergency preparedness, response and recovery.

**Support vulnerable communities** during climate-related events and contribute to the development of Community Resilience Plans.

**Establish systems to quantify and report** on climate-related transport network incidents.

**Integrate climate risk assessment** into decision making to address climate change across all asset and project life cycles, and to understand when to defend against, accommodate or retreat from climate-related hazards.

## Embed climate considerations

in budgeting, procurement, business case development and life-cycle planning to ensure the sustainable financing of transport infrastructure and assets.

**Invest in trials of innovative solutions** to deal with future climate change impacts.

**Share knowledge** among transport agencies and critical infrastructure transport operators through the Transport Sector Resilience Network.





## CASE STUDY

### Victoria's Sustainability Bond

In some cases, existing economic and financial frameworks have the potential to limit adaptation and undermine our resilience to climate change. We need to develop innovative tools to incentivise and fund activities that integrate climate resilience.

Sustainability bonds prioritise environmental and social benefits that are not yet integrated into existing economic and financial frameworks and instruments. The Treasury Corporation of Victoria launched its inaugural sustainability bond in September 2021. It will finance a mix of 'green' and 'social' projects certified under principles set by the International Capital Markets Association.

The projects will support climate change adaptation and resilient infrastructure, sustainable water and wastewater management, and sustainable management of natural resources and land use. The bond provides a framework for the Victorian Government to target investors who are focused on environmental, social and governance outcomes and highlight Victoria's investment in these areas.

Investors initially contributed \$2.5 billion into the bond. This amount is expected to increase substantially over time with the Treasury Corporation of Victoria's financing strategy.<sup>38</sup>

### Key 'green' projects financed through the bond<sup>39</sup>

**\$420M**

capital contribution towards a total investment of

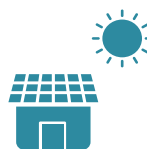
**\$2.3B**

for High Capacity Metro trains with improved passenger capacities



**\$880M**

investment in the Solar Homes Program



**\$540M**

for improved renewable electricity network resilience



**\$335M**

for thermal upgrades and energy-efficient heating and cooling for low-income properties, and

**\$112M**

for social housing





# Water Cycle

## The challenge

The Water Cycle system involves the collection, storage, treatment, delivery and supply of water, as well as services for managing wastewater, drainage and flooding. The impacts of climate change are already being felt across the Water Cycle system and are likely to increase. As Victoria becomes warmer and drier, less runoff will reach rivers, streams, dams, and groundwater. Addressing the impacts of climate change is important due to our reliance on climate-dependent sources of water found in reservoirs, rivers, lakes and groundwater.







Victoria's water corporations operate and maintain more than \$48 billion of infrastructure, with asset lives of up to 100 years. Climate change sits alongside other pressures on water resources, such as population growth and changing economic conditions. If we don't adapt effectively to climate change, we could experience:

- / less water available for the environment, community and businesses
- / increased prices for water services
- / damage to infrastructure needed for essential water and wastewater services
- / restrictions on water for recreation and private gardens
- / drainage being overwhelmed, increasing flood damage and sewer spills
- / peaks in water demand during heatwaves that could exceed the capacity of available water.

The Water Cycle system is also central to many opportunities to address climate change – for example, through converting wastewater to energy to support a circular economy, or through recycling water to augment existing water supply. Nature-based solutions can also offer multiple benefits – for example, planting vegetation along waterways can reduce flood impacts, improve water quality and help shade the surrounding environment.

## Work already underway

**Providing leadership on water and adaptation** through Water for Victoria (the long-term plan for the water sector) and the *Pilot Water Sector Climate Change Adaptation Action Plan 2018–2020*.

**Investing more than \$2.7 billion in water infrastructure** over the past decade to improve water efficiency and reliability in regional communities.

**Preparing an annual water outlook** to inform the community on the management of different water uses under forecast conditions.

**Providing hydrology and climate science** for Victoria's water sector and supporting citizen science.

**Delivering regional catchment strategies** that prioritise ongoing stewardship of catchments through local and regional partnerships between catchment management authorities, Traditional Owners and the broader community.

## Implementing urban water strategies and drought preparedness plans

developed by urban water corporations to manage systems during extreme dry periods and water quality events.

**Collaborating with industry** to invest in improved knowledge, pilot new technologies and stress-test the water grid.

**Collaborating on place-based management** of all elements of the water cycle through integrated water management forums.

**Providing rebates and education campaigns** for vulnerable customers, schools and communities to use water more efficiently and save on water bills.

**Coordinating state-level responses** to manage algal blooms.

**Improving the resilience of water and flood monitoring** stations as part of Victoria's Bushfire Recovery Plan.

**Financing investments in water corporations** using green bonds, primarily to reduce emissions through treatment plant upgrades and renewable energy installation.



## Key priorities ahead

The next 5 years (2022–2026) will be focused on integrating climate change adaptation across all aspects of the Water Cycle system.

**Investigate ways to diversify and augment** water supplies, including by enabling greater use of stormwater and recycled water.

**Examine co-investment opportunities** to deliver water infrastructure with the community, private investors and government partners.

**Enhance climate-related hazard and risk assessment** capabilities to support water infrastructure planning, design and investment decisions.

**Identify opportunities** to strengthen the water sector's emergency capability, systems and processes for resource sharing.

**Prioritise greater Traditional Owner participation** in water cycle adaptation.

**Explore new water efficiency standards** for homes and review existing building and plumbing requirements for rainwater tanks and water efficiency.

**Promote innovation** to reduce Victoria's water-related emissions across households and businesses, build climate resilience and transition to a circular economy, including by trialling measures to reduce water-related energy use.





# Climate resilience helps to secure Victoria's future

## Delivering on Victoria's adaptation priorities for the next 5 years

The Adaptation Action Plans are an important step forward for achieving the 5-year priorities and 2050 vision set out in *Victoria's Climate Change Strategy*.

Together with Victoria's community-led adaptation action, the plans will help ensure Victoria is ready for current and future climate change.

Adapting to climate change is inherently uncertain – we cannot be sure of what others will do to reduce emissions, nor can we know precisely how our climate will change. For this reason, Victoria's plans are not set in stone. Instead, our plans will evolve and grow as we partner with one another to act, learn and continually adjust to our changing climate.

## Supporting transformational adaptation over the coming decades

*Victoria's Climate Change Strategy* includes a commitment to enabling transformational adaptation, looking to the end of this decade and beyond.

Transformational adaptation means taking more than just small or incremental actions to respond to climate change. It requires us to understand the actions needed to make our communities and ecosystems more resilient to major, long-term or irreversible environmental changes. This will involve continuously assessing our different systems' vulnerabilities and identifying possible environmental thresholds and tipping points.

Building climate resilience will require some trade-offs between the needs of current and future generations to protect the long-term interests of Victorian communities, businesses and ecosystems.

The Victorian Government will ensure all voices are heard in working to identify the transformational change needed to ensure a climate-resilient Victoria for generations to come. It will test and learn from different transformative approaches from Victoria, Australia and around the world.

Victoria is committed to continued strong action on climate change to help secure a prosperous and liveable future for our state.

# Endnotes

1. Intergovernmental Panel on Climate Change (IPCC), 'Summary for Policymakers', in V Masson-Delmotte, P Zhai, A Pirani, S L Connors, C Péan, S Berger, N Caud, Y Chen, L Goldfarb, M I Gomis, M Huang, K Leitzell, E Lonnoy, J B R Matthews, T K Maycock, T Waterfield, O Yelekçi, R Yu and B Zhou (eds) *Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, 2021.
2. Intergovernmental Panel on Climate Change (IPCC), 'Summary for Policymakers', in V Masson-Delmotte, P Zhai, A Pirani, S L Connors, C Péan, S Berger, N Caud, Y Chen, L Goldfarb, M I Gomis, M Huang, K Leitzell, E Lonnoy, J B R Matthews, T K Maycock, T Waterfield, O Yelekçi, R Yu and B Zhou (eds) *Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, 2021.
3. State Government of Victoria Department of Environment, Land, Water and Planning, *Budget 2021-22*, DELWP website, 2021, accessed 26 October 2021.
4. State Government of Victoria Department of Environment, Land, Water and Planning, *Budget 2021-22*, DELWP website, 2021, accessed 26 October 2021.
5. State Government of Victoria Department of Environment, Land, Water and Planning, *Managing extreme water shortage in Victoria: Lessons from the Millennium Drought*, DELWP website, 2016, accessed 26 October 2021.
6. State Government of Victoria Department of Treasury and Finance, *2020-21 State Budget Jobs Plan*, DTF website, 2020, accessed 7 February 2022.
7. State Government of Victoria Department of Environment, Land, Water and Planning, *Draft Marine and Coastal Strategy*, DELWP website, 2021, accessed 26 October 2021.
8. Country Fire Authority, *Disaster Resilience Education Victoria*, CFA website, 2021, accessed 10 December 2021.
9. State Government of Victoria Department of Environment, Land, Water and Planning, *Victoria's Household Energy Savings Package*, DELWP website, 2021, accessed 23 December 2021.
10. State Government of Victoria Department of Environment, Land, Water and Planning, *Victorian Government stimulus package*, DELWP website, 2020, accessed 7 February 2022.
11. State Government of Victoria Department of Environment, Land, Water and Planning, *Macalister Irrigation District modernisation project – Phase 2*, DELWP website, 2021, accessed 12 October 2021.
12. State Government of Victoria Department of Environment, Land, Water and Planning, *Budget 2021-22*, DELWP website, 2021, accessed 26 October 2021.
13. Premier of Victoria, *Creating Safer Energy Networks In Bushfire Regions* [media release], Victorian Government, 25 October 2021, accessed 26 October 2021.
14. State Government of Victoria Department of Environment, Land, Water and Planning, *Powerline replacement*, DELWP website, 2021, accessed 26 October 2021.
15. State Government of Victoria Liveability Victoria International *Victoria a magnet for international delegations seeking expertise on liveability* [media release], Liveability Victoria International website, 2 December 2019, accessed 14 January 2022.
16. State Government of Victoria Department of Jobs, Precincts and Regions, supplied analysis, 2021.
17. L Martinez-Diaz, 'Investing in resilience today to prepare for tomorrow's climate change', *Bulletin of the Atomic Scientists*, 2018, 74:2, 66-72, DOI:10.1080/00963402.2018.1436805
18. [Figures are 2019 dollars, real, discounted.] T Kompas, E Witte, and M Keegan, *Australia's Clean Energy Future: Costs and Benefits*, MSSI Issues Paper 12, Melbourne Sustainable Society Institute, The University of Melbourne, 2019, accessed 19 November 2021.



19. The Investor Agenda, *Investors release plan to establish mandatory financial disclosure on climate risk in Australia* [media release], Investor Group on Climate Change website, 29 June 2021, accessed 29 September 2021.
20. J Ward, 'A climate reckoning is coming for the world's government debt', *Sydney Morning Herald*, 24 September 2021, accessed 24 September 2021.
21. Victorian Auditor-General's Office, *Protecting Victoria's Coastal Assets*, VAGO website, 2018, accessed 20 October 2021.
22. State Government of Victoria Department of Environment, Land, Water and Planning, *The economic impact of heatwaves on Victoria*, DELWP website, 2019, accessed 29 September 2021.
23. Sustainability Victoria, *Victorians' perceptions of climate change: Key findings – social research on climate change attitudes and behaviours*, Sustainability Victoria website, 2017, accessed 15 October 2021.
24. Victorian Council of Social Service (VCOSS), *A climate of fairness*, VCOSS, 2019, accessed 29 September 2021.
25. State Government of Victoria Department of Environment, Land, Water and Planning, *Victoria's Household Energy Savings Package*, DELWP website, 2021, accessed 23 December 2021.
26. State Government of Victoria Department of Environment, Land, Water and Planning, *More trees for a cooler greener west*, DELWP website, 2021, accessed 15 October 2021.
27. Sustainability Victoria, *Victorians' perceptions of climate change: Key findings – social research on climate change attitudes and behaviours*, Sustainability Victoria website, 2017, accessed 15 October 2021.
28. State Government of Victoria Department of Education and Training, *School operations: Heat health*, DET website, 2021, accessed 12 October 2021.
29. State Government of Victoria Department of Education and Training, *Bushfire 2020: information for schools*, DET website, 2021, accessed 12 October 2021.
30. State Government of Victoria Department of Education and Training, *Bushfire and Grassfire Preparedness*, DET website, 2021, accessed 12 October 2021.
31. State Government of Victoria Department of Education and Training, *Bushfire At-Risk Register (BARR)*, DET website, 2021, accessed 12 October 2021.
32. World Health Organization (WHO), *WHO calls for urgent action to protect health from climate change – Sign the call* [media release], 6 October 2015, accessed 12 October 2021.
33. State Government of Victoria Department of Environment, Land, Water and Planning, *Victoria's bushfire emergency: Biodiversity response and recovery*, DELWP website, 2021, accessed 12 October 2021.
34. Inspector-General for Emergency Management, *Inquiry into the 2019-20 Victorian fire season – Phase 1: Community and sector preparedness for and response to the 2019-20 fire season*, IGEM website, 2020, accessed 20 December 2021.
35. State Government of Victoria Department of Treasury and Finance, *The economic impacts of the 2019-20 bushfires on Victoria*, *Victoria's Economic Bulletin*, Volume 5, DTF website, June 2021, accessed 29 September 2021.
36. Bushfire and Natural Hazards Cooperative Research Centre (CRC), *PHOENIX RapidFire*, Bushfire and Natural Hazards CRC website, 1 December 2020, accessed 29 September 2021.
37. State Government of Victoria, *Research modelling and knowledge application*, Safer Together website, 2020, accessed 29 September 2021.
38. Treasury Corporation of Victoria, *TCV Sustainability Bond Issuance*, Treasury Corporation of Victoria website, September 2021, accessed 7 October 2021.
39. Treasury Corporation of Victoria (2021) *TCV Sustainability Bond – Project Pool Summaries*, Treasury Corporation of Victoria website, September 2021, accessed 7 October 2021.

