

# Bega Valley Shire **Climate Resilience Strategy**

A green circle with a white border containing the year "2050" in white text. The circle is positioned over a background image of a river and is partially overlaid by a decorative wavy band in green, orange, and blue.

2050

A photograph of a river flowing through a lush green landscape with trees and bushes. The river has some sandbars and is surrounded by dense vegetation. The sky is clear and blue.

**DRAFT**



## Acknowledgment

The Bega Valley Shire Council acknowledges the traditional custodians of the lands and waters of the Shire, the people of the Yuin nations, and show our respect to elders past, present and emerging.

# Executive summary

This draft Bega Valley Shire Climate Resilience Strategy aims to ensure that our community, environment and economy are robust and able to respond to the key challenges that climate change presents.

Our towns, villages, key infrastructure, agricultural and tourism-based industries and our health and wellbeing all have varying degrees of vulnerability to climate changes impacts.

Our natural systems underpin all aspects of our lives and are important to our wellbeing. If well managed, they also have the capacity to support our community to mitigate and adapt to a changing climate.

Bega Valley Shire Council has recently resolved to increase its prioritisation on climate change response. This draft Strategy is the strategic document through which this enhanced focus on climate resilience action is realised. It presents performance measures and targets (Table 1) for a more equitable, sustainable and resilient future for the Shire.

A resilience approach focuses on building strong foundations for our Shire. A resilient Bega Valley Shire will be prepared for shocks and stressors, be they financial, environmental, social or political.

We are not starting from scratch. There has been an extensive body of work already undertaken to respond to climate change across the Shire and we hold a powerful resource in the knowledge and skills of local people.

The success of this Strategy relies on its ability to communicate a shared vision for a resilient Shire, to which we can all contribute. Council invites you to participate in shaping that vision by providing feedback on this draft.



**Table 1: Key Response Areas Performance Measures and Targets**

Key Response Areas	Performance Measures and Targets by 2050
Natural Systems – Coasts and Marine	<ul style="list-style-type: none"> <li>• Increase in area of wetland protected</li> <li>• Increase in estuarine health</li> </ul>
– Catchments and Forests	<ul style="list-style-type: none"> <li>• Increase in area of endangered ecological communities protected</li> <li>• Increase in condition of riparian corridors</li> <li>• Increase in average annual stream flow volumes as measured at Morans Crossing, Kanoona and Angledale</li> </ul>
Preparing for Natural Hazards	<ul style="list-style-type: none"> <li>• Increase in beach dune sand volume</li> <li>• Increase in number of dwellings designed to withstand natural disasters</li> <li>• Reduction in annual average insured losses</li> </ul>
Liveable & Connected Places	<ul style="list-style-type: none"> <li>• Increase in population living within 800 metres of the centres of our major towns</li> <li>• Increase in use of active transport</li> <li>• Reduction in waste to landfill</li> </ul>
Safe, Healthy and Inclusive Community	<ul style="list-style-type: none"> <li>• Reduction in heat related morbidity and mortality</li> <li>• Increase in volunteer hours</li> <li>• Improvement in average SEIFA relative socio-economic advantage and disadvantage index</li> </ul>
Diverse & Thriving Economy - Dairy and Agriculture	<ul style="list-style-type: none"> <li>• Increase in area of existing rural land being actively farmed for food and fibre production</li> <li>• Increase in catchment storage capacity across the Bega, Brogo and Towamba River Basins</li> </ul>
- Tourism	<ul style="list-style-type: none"> <li>• Increase in the value of visitor economy</li> </ul>
- Transport and Logistics	<ul style="list-style-type: none"> <li>• Increase in electric vehicle registration</li> <li>• Reduction in per pallet freight relative cost</li> </ul>
- Aquaculture, Fishing and Forestry	<ul style="list-style-type: none"> <li>• Increase in aquaculture production</li> <li>• Increase in value of timber production</li> </ul>
Energy Security	<ul style="list-style-type: none"> <li>• Reduction in cost of household energy</li> <li>• Net zero emissions (with interim target of 100% renewable electricity by 2030)</li> </ul>
Food Security	<ul style="list-style-type: none"> <li>• Increase in locally produced food</li> <li>• Increase in area of land zoned for small lot agriculture</li> </ul>



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## Table fo Acronyms

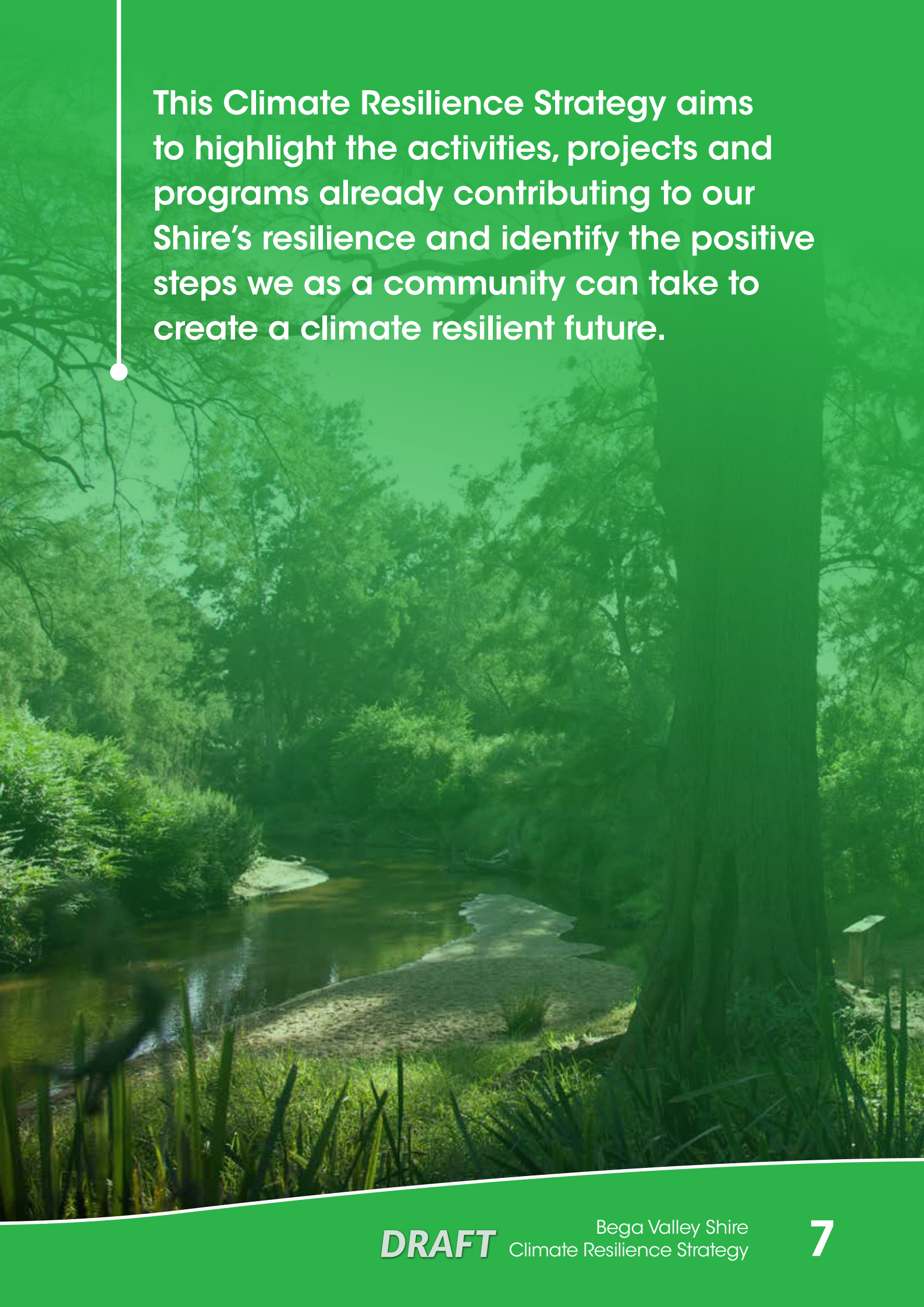
### Agency

Bega Valley Shire Council  
 NSW Rural Fire Service  
 Water NSW  
 Marine Estate Management Authority  
 Department of Primary Industries  
 NSW Health  
 Roads and Maritime Service  
 Essential Energy  
 Office of Emergency Management  
 Department of Planning, Industry & Environment  
 Local Land Services  
 State Emergency Service  
 Forestry Corporation, NSW  
 National Parks and Wildlife Service  
 National Broadcasting Network  
 Telstra  
 Universities  
 Industry  
 Local Aboriginal Land Councils  
 Community

### Abbreviation

BVSC  
 RFS  
 WATER  
 MEMA  
 DPI  
 HEALTH  
 RMS  
 EE  
 OEM  
 DPIE  
 LLS  
 SES  
 FCORP  
 NPWS  
 NBN  
 TELSTRA  
 UNI  
 IND  
 LALCS  
 COM



A lush green landscape with a river flowing through dense trees and vegetation. The scene is captured from a low angle, looking down the river towards a small island in the distance. The water is calm, reflecting the surrounding greenery. The trees are tall and leafy, creating a canopy over the river. The overall atmosphere is peaceful and natural.

This Climate Resilience Strategy aims to highlight the activities, projects and programs already contributing to our Shire's resilience and identify the positive steps we as a community can take to create a climate resilient future.





# Towards a Climate Resilient Bega Valley Shire

## Background

A changing climate provides challenges to people across the Bega Valley, potentially exacerbating existing vulnerabilities and creating new threats to our natural systems, communities, economy and built environment. It also provides great opportunities through early adaptation, efficient transition to a low-carbon economy, and development of new industry and technological opportunities that create jobs and benefit all residents.

In August 2019, Council resolved to recognise the climate emergency, through the strength, scope and immediacy of initiatives for Council and the community to combat climate change ensuring the continued economic and social viability of agricultural and transport sectors in the Bega Valley. In order to meet these challenges, we need to ensure that the economy, environment and social fabric of our Shire are resilient to change. A resilient and robust Bega Valley Shire will be prepared for shocks and stressors, now and in the future, be they financial, environmental, social or political. While this Bega Valley Shire Climate Resilience Strategy is intended to ensure that our Shire is prepared for the impacts of climate change, its success lies in being equitable for our community, strengthening our natural systems and enhancing quality of life for our residents.



While this Strategy is fundamentally intended to ensure that our Shire is prepared for the impacts of climate change, its success lies in being equitable for our community, strengthening our natural systems and enhancing quality of life for our residents.



This Strategy supersedes the Bega Valley Shire Climate Change Strategy (2014 -2017), which focused on the operations of Bega Valley Shire Council, this Strategy applies to the whole Shire.

## Our first resilient peoples

The First Australians are arguably the most resilient culture on earth with over 50,000 years of continuous occupation of this land. The Aboriginal people experienced periods of extreme climatic variability, varied sea levels and adapted to the full range of Australian landscapes.

People of the Yuin Nation have sustainably lived in what is now the Bega Valley Shire for many thousands of years. Their successful and resilient interaction with our local environment for countless generations, provides clear direction for current residents of the Bega Valley Shire to achieve a resilient community that is well prepared to deal with the impacts of a changing climate.

## Input to this strategy

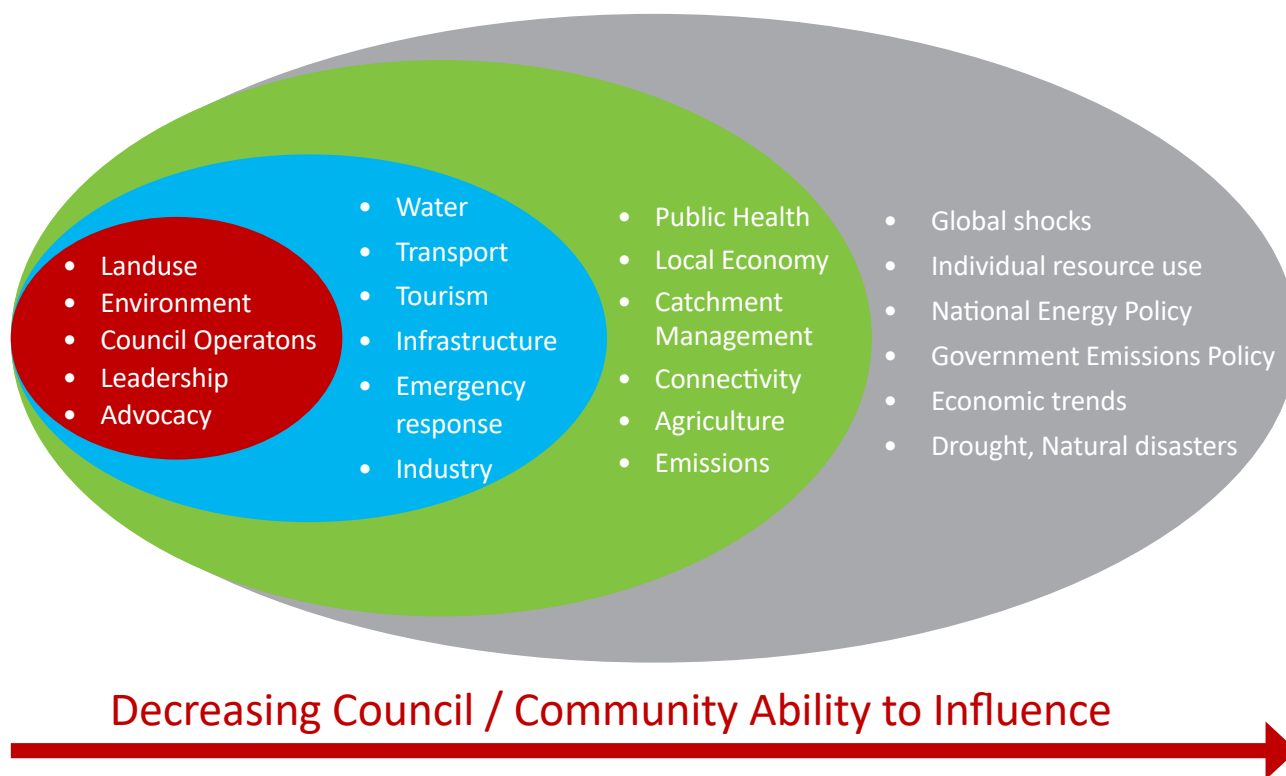
This Strategy has been developed with input from a wide range of stakeholders across the Bega Valley Shire. A Technical Advisory Group, comprised of local residents, contributed significantly to the form and content of the document. Important contributions were also made by business, government and not-for-profit representatives across the Shire.

The Strategy was publicly exhibited to seek broader community input.

***[Further detail to be inserted following public exhibition]***

## Council's Contribution to this strategy

Climate change is a global, national and local issue. Enhancing our community's resilience to the impacts of a changing climate is the responsibility of all levels of government as well as the business, government, not-for-profit sectors and individuals. While Bega Valley Shire Council recognises that local government has an important role increasing our Shire's resilience that allows us to have a good foundation to implement both climate change mitigation and adaptation actions. However as discussed earlier it is also important to recognise that many strategies to increase our community's resilience across a range of sectors sit outside of the statutory responsibility or influence of local government (Figure 1).



**Figure 1:** Continuum of influence on climate change impacts

The scope of this Strategy is limited to the geographic area of the Bega Valley Shire, including the operational responsibilities of Council. With regard to mitigation, Council's responsibilities relate to reducing its own emissions and encouraging and supporting the community to reduce their emissions through education, behaviour change programs and planning and development processes (Tables 2 and 3).

**Table 2 – Climate resilience activity that is directly within Council's sphere of influence**

<b>Within Scope (Direct Council Influence)</b>	
Natural systems	Council's environmental management activities on Council managed natural areas will be based on resilience principles to ensure our approach is responsive to a changing climate.
Council owned infrastructure, assets and land	Identifying risks to Council owned infrastructure and assets as a result of climate change and planning for the protection and/or adaptation of these infrastructure and assets.
Energy efficiency and renewable energy	Reduction in energy consumption of Council operations and facilities and encouraging renewable energy development to support Council infrastructure.
Water supply	Implementing water use efficiency measures in preparation for predicted reductions in rainfall through effective water management, reduced consumption and use of alternative water sources.
Land use planning	Ensuring Council's strategic land use planning documents embed climate resilience actions.
Natural hazard planning	Council has an important role in understanding and preparing for natural hazards and the impact of climate change in exacerbating existing natural hazard threats to our resilience.
Local economy	Council's economic development initiatives and policy levers can assist our local economy strengthen its resilience to a changing climate.





**Table 3 – Climate resilience activity that is indirectly within Council's sphere of influence**

Element	Area of indirect influence
Preparing communities for climate change impacts	The health (physical and mental) and wellbeing of individuals may be affected by climate change. Council in partnership with other levels of government can support and encourage residents to become more resilient to climate change impacts.
Adaptation of private property	Council and other levels of government provide advice and best practice guidance to our residents and communities about climate change resilience and adaptation for private property.
Emergency management	NSW government agencies retain the lead role in the delivery of emergency management services.
Natural systems	The natural environment (habitats, flora and fauna) will respond and adapt to a changing climate. Council will partner with land management and NRM agencies to support the resilience of the natural environment.
Infrastructure, assets and land	Identifying climate change related risks to State owned infrastructure and assets as a result of climate change and planning for the protection and/or adaptation of these infrastructure and assets.
Energy efficiency and renewable energy	Support our residents and business in identifying opportunities to reduce their energy consumption and provide assistance in transitioning to renewable energy installation opportunities. Work with energy suppliers and distributors to ensure supply security and grid capacity.
Water supply	Advocating with State Agencies to achieve greater water storage, catchment management and sustainable water access.
Land use	Collaborate with NSW government agencies to ensure land use policy embeds climate resilience.
Natural hazard planning	Working with Commonwealth and NSW government agencies, research bodies and universities to have the best available science to underpin our preparation and strategic planning for changes in our exposure to natural hazards.
Local economy	Supporting individual businesses and industry sectors to make investment and strategic decisions that build their resilience.





# Why a Resilience Approach?

## What is resilience?

The capacity of individuals, communities, institutions, businesses, and natural systems within our Shire to recover, build back better and grow, no matter what kinds of stresses and shocks they experience.

This Strategy adopts a resilience approach in order to respond to the key challenges that climate change will present. A resilience approach allows our community to focus on enhancing the strong foundations that underpin our Shire, that in turn allow us to implement adaptation and mitigation measures to address these challenges.

To ensure the Bega Valley Shire, our natural systems, communities, infrastructure and economy are prepared for the impact of climate change it is imperative to embed a resilience approach. Actions to address climate change or increase resilience of our community can no longer be seen as individual separate actions or programs. Every decision about the future of the Shire, each new policy approach or new project should build the resilience of the places and individual communities touched by these decisions.

Bega Valley Shire Council will expand resilience thinking throughout its operations and long-term planning to drive the successful implementation of this Strategy. This will require cross -organisational cooperation in identifying outcomes that achieve multiple long-term benefits for the whole of community and increase the Shire's resilience to climate change.

Examples of how our community is already demonstrating its resilience are provided in Appendix 1.

## Shocks and stressors

Bega Valley Shire residents engage with climate vulnerabilities and risk every day. Our resilience to our variable and changing climate is influenced by the physical geography of our Shire, natural environmental fluctuations, distance between our towns and villages, extensive infrastructure network, reliance on external economic and energy fluctuations, limited industry diversity and local socio-economic issues and housing availability.

These vulnerabilities have historically been impacted by long term stressors such as drought and water availability, unemployment, lack of public transport and low average household income across the Shire. Overlying these ongoing stressors are historic acute shocks such as the 1971 and 2011 floods; the 1952, 1980 and 2018 bushfires; 2016 East Coast Low, closure of the Heinz cannery in Eden, Commonwealth and State fishery buyouts and the 2002 toxic algal event in Wonboyn Lake.

Bega Valley Shire is among the most desirable places to live in Australia, but also poses unique challenges for resilience. For example, our coastline has significant natural values that contribute to our quality of life, aquaculture and fishing industries and is the main attraction for the thousands of tourists who visit our Shire each year. However, our 225km long coastline will face some of the greatest climate change driven impacts through increased sea levels, changes to ocean temperature and acidity, and increased severity of coastal storms.

Climate change will likely exacerbate many our existing stressors and the impact and severity of future environmental, economic and social shocks. The adoption of a resilience approach will ensure our Shire, environment, community and economy are better able to withstand these stressors and shocks. Just as the shocks and stressors we face will continue to evolve, this Strategy is not static in nature and must be flexible and forward looking to identify and manage emerging challenges.

Stressors are conditions that weaken our Shire on a daily or reoccurring basis, such as drought, social isolation, unemployment, housing availability and poverty.



Shocks are sudden-onset events, such as, floods, bushfires, extreme weather, industry closure and disease outbreaks.







# Key principles for success

In order for this Strategy to be successful in enhancing the Shire's resilience and ability to withstand future climate driven shocks and stressors the following principles are critical.

## Focusing on our shared values

The successful transition to a climate resilient Bega Valley Shire will be best achieved through a focus on the attributes that are valued by residents across the Shire. In recent years Council has undertaken extensive community engagement to understand what our residents value about the Shire.

Our natural environment and the role it plays in our lifestyle has consistently been highly valued by the majority of our residents. The ability to access key services, improved connectivity between towns and within existing towns and neighbourhoods and the need for public transport are social based values that are consistently raised by people across the Shire. A thriving economy, safe and inclusive communities, access to housing and education, and an industry growth based on innovation are other community and economic values that are relevant to all sectors of our community. A focus on the protection and enhancement of these values will provide a positive driver to underpin the implementation of climate resilience actions.

## Understanding through meaningful engagement

It is important to understand the current vulnerabilities and stressors that are impacting our community as part of developing practical and achievable actions.

Engagement needs to be ongoing throughout the implementation of this Strategy development. The aspirations and vulnerabilities of our residents will differ from house to house and town to village and it is vital that resilience actions recognise and cater for these variabilities.

## Equitable access to climate resilience

Climate change affect all members of the Bega Valley Shire community. Conversely our efforts to reduce our community's contribution to climate change and prepare for its predicted impacts should be equitably distributed. Our implementation approach must help share the opportunities and benefits of climate action equitably.

## We must work together

Climate resilience cannot be achieved by any one group or individual in isolation. Businesses, residents, institutions and non-profit organisations all have essential roles to play. Our joint responsibility will ultimately determine our success in embedding resilience into all aspects of our lives in the Bega Valley Shire. We all make small daily choices, which, when viewed collectively, present a tremendous opportunity to make meaningful progress to achieving climate resilience.







# A Changing Climate

The global climate is undergoing change. In 2017 atmospheric carbon dioxide levels reached 405ppm, a level not reached for some 2 million years. Australia is home to one of three Global Atmospheric Monitoring stations at Cape Grim, Tasmania, which has recorded substantial increases over the last 40 years (Figure 2). The amount of greenhouse gas abatement the global community undertakes will affect future levels of carbon dioxide (Figure 3), with significant impacts for our climate (Figure 4).

Australians contribute about 21.50 tonnes of carbon dioxide equivalents per capita<sup>7</sup> to global greenhouse gas emissions, which are among the highest in the world. The contribution of Bega Valley Shire is estimated to be 15.25 tonnes of carbon dioxide.

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<sup>7</sup> Department of Energy and Environment



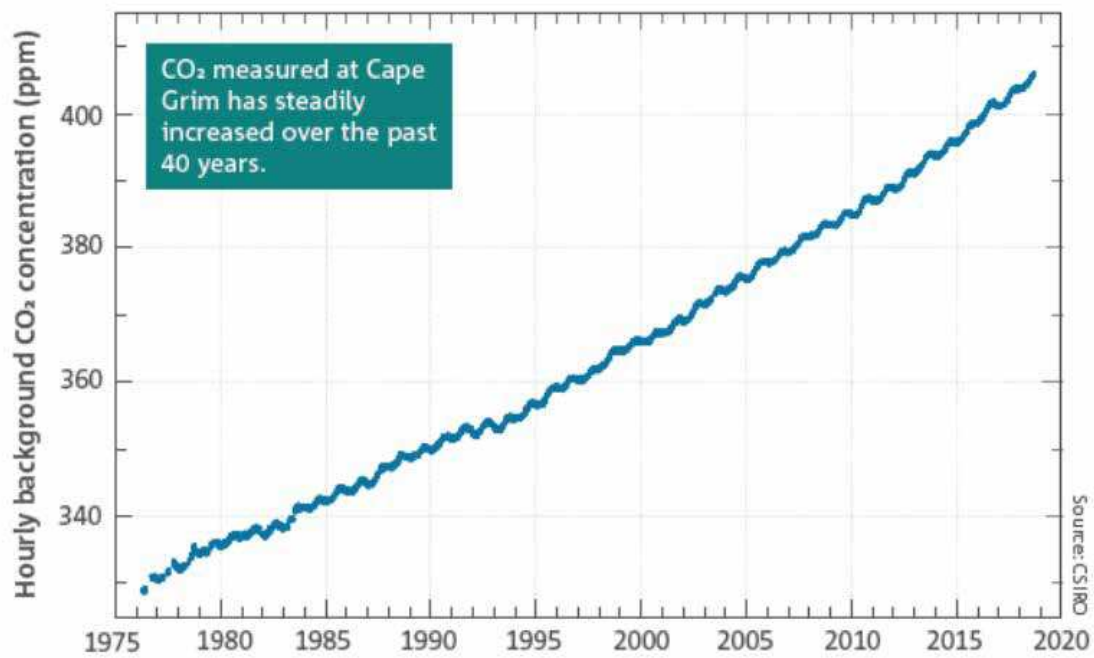


Figure 2 : CO<sub>2</sub> Measurements Cape Grim, Tasmania

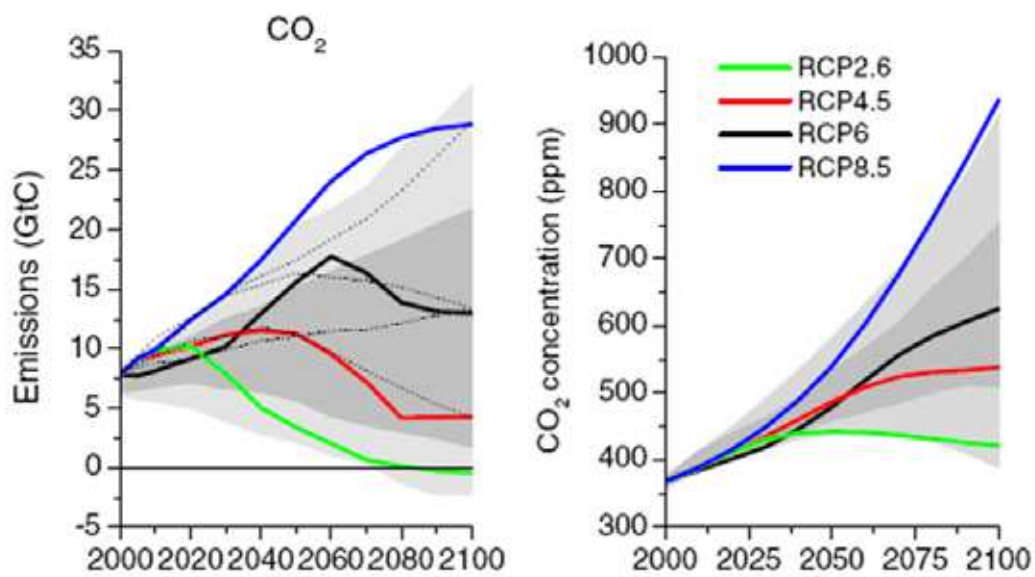
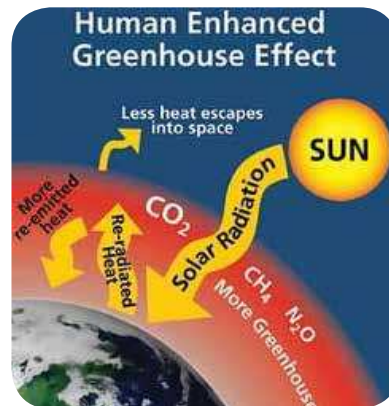


Figure 3: Modelling Global Emission and Concentration

# How a changing climate impacts our resilience

## Primary climate driver

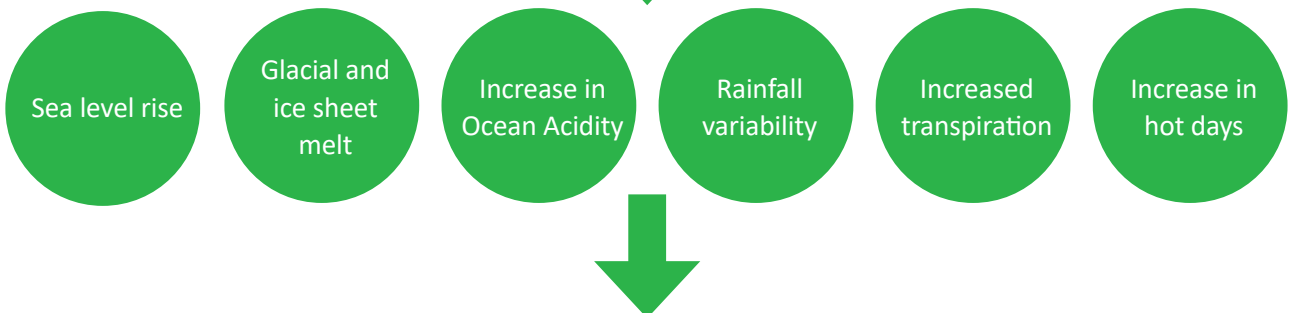
Increasing level of greenhouse gases drive global warming



## Secondary climate drivers

- Increased average temperatures
- Increased precipitation variability
- Increased ocean temperature
- Changes to weather systems
- More intense storms

## Global climate impacts



## Local climate change impacts exacerbate our vulnerabilities and reduce resilience

- Foreshore erosion – beaches and estuaries
- Reduction in catchment water flows
- Inundation of low lying areas
- Changes in species distribution
- Loss of calcium carbonate in shellfish

- Prolonged bushfire season
- Extended periods of drought
- More frequent heatwaves
- Reduction in soil moisture
- More extreme storms

Figure 4 – Impact of atmospheric carbon dioxide concentrations on our climate

These changes have significant implications for the climate of Australia and that of South East NSW.

## Australia

- Australia's climate has warmed by slightly over 1 °C since 1910, leading to an increase in the frequency of extreme heat events.
- Oceans around Australia have warmed by around 1 °C since 1910, contributing to longer and more frequent marine heatwaves.
- Sea levels are rising around Australia, increasing the risk of coastal inundation.
- The oceans around Australia are acidifying (the pH is decreasing).
- April to October rainfall has decreased in the southwest of Australia. Across the same region May–July rainfall has seen the largest decrease, by around 20 per cent since 1970.
- There has been a decline of around 11 per cent in April–October rainfall in the southeast of Australia since the late 1990s.
- Rainfall has increased across parts of northern Australia since the 1970s.
- Streamflow has decreased across southern Australia. Streamflow has increased in northern Australia where rainfall has increased.
- There has been a long term increase in extreme fire weather, and in the length of the fire season, across large parts of Australia<sup>7</sup>.

The complexity and scale of global climate models makes downscaling climate projections to a shire-scale difficult. There are ongoing improvements to the accuracy and the regional downscaling of climate modelling and forecasting by bodies such as the CSIRO, the Bureau of Meteorology (BoM), universities and government agencies.

The NSW Government's Adapt NSW program has produced a climate snapshot that encompasses the Bega Valley Shire. BoM and CSIRO have also produced projections for NRM regions, with our Shire falling into the 'Southern Slopes' region.

Due to the broad and different regions covered by the two forecast snapshots, Council has engaged climate specialists in the NSW Department of Planning, Industry and Environment to produce climate forecasts of greater relevance to our Shire.

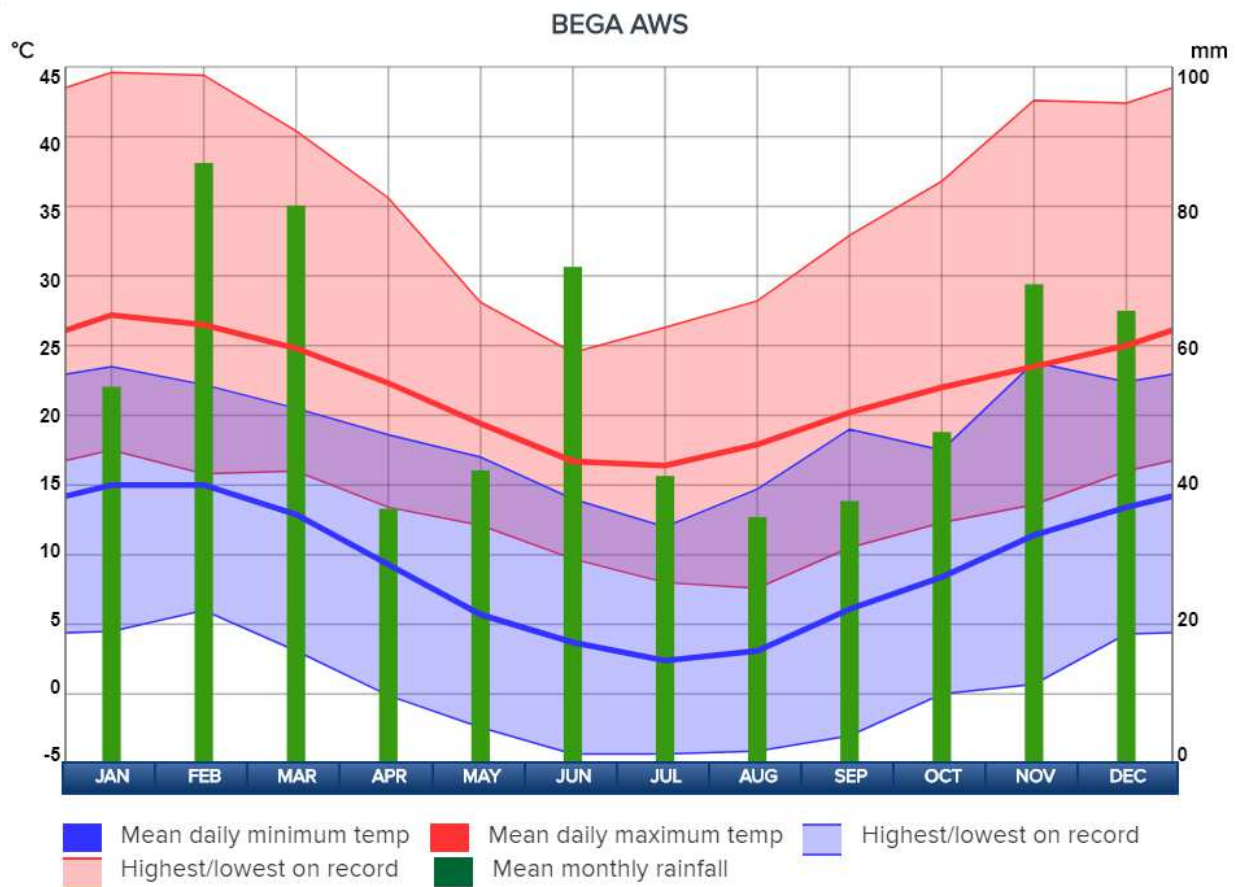
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<sup>7</sup> CSIRO State of the Climate Report, 2018



## Current Bega Valley Shire climate variability

Bega Valley Shire has a temperate climate, strong seasonality and exposure to a range of climate factors (Figure 5).

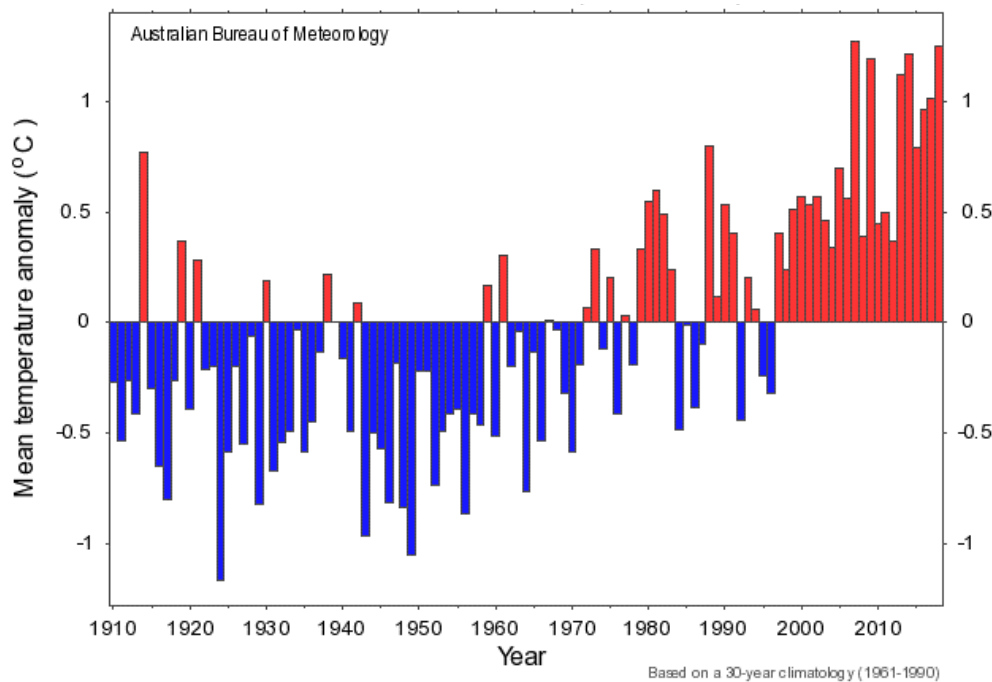


**Figure 5:** Monthly distribution of Bega temperature (°C) and total rainfall (mm/month) for the 1992-Present period. Red/blue shading indicates the range of daily max/min temperatures within each month, and the solid red/blue curves indicate the average max/min temperatures in each month. Green bars indicate total rainfall in each month. Source: Weatherzone.

## Temperature

The annual mean temperature in south-eastern Australia is currently approximately 1°C warmer than the late 20th century average. Temperature trends over the past 50 years indicate an increase in annual mean temperature by 0.2-0.3°C, driven by increased warming in summer and spring.

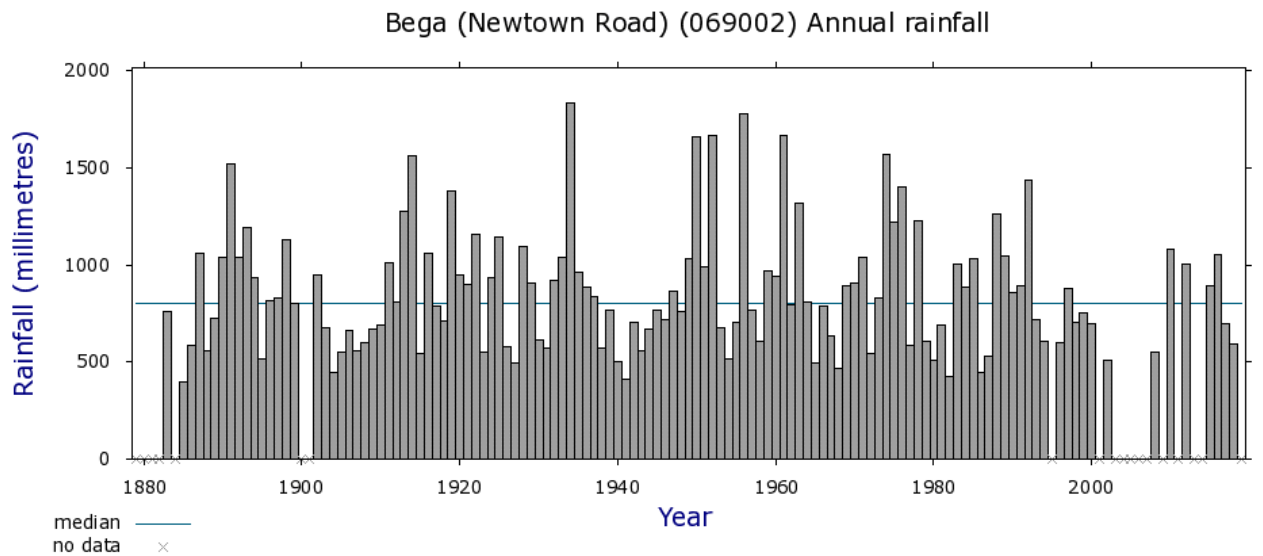
The timeseries of south-eastern Australia (including Bega, but also extending south to Tasmania) indicates a clear warming trend over the past approximately 100 years of 1 to 1.5°C at present above the 1960-1990 average (Figure 6).



**Figure 6:** The annual mean temperature anomaly (difference from the 1960-1990 average; °C) average over south-eastern Australia. The blue bars indicate that the annual mean temperature in that year was below the 1960-1990 average; the red bars indicate it was above. Source: Bureau of Meteorology.

## Rainfall

The median annual rainfall for the Bega weather station is approximately 800mm/year since the late 19th century, with wet and dry periods cycling on 5-10 year timescales (Figure 7). There is slightly higher rainfall in the northern and southern part of the Shire, and slightly lower values in between. The rainfall is distributed approximately evenly across the four seasons, with largest rainfall totals in the summer.



Climate Data Online, Bureau of Meteorology  
Copyright Commonwealth of Australia, 2018

**Figure 7:** Total annual rainfall (mm/year) at the Bega weather station from the late 19th century to 2018. Some years have incomplete data, indicated by a 'x'. The blue line represents the median over the timeseries. Source: Bureau of Meteorology.





# NSW/ACT Regional Climate Modelling (NARClIM) projections

NARClIM is a set of twelve regional dynamically downscaled climate projections, developed by the NSW Government and the University of New South Wales. They provide localised projections of international global climate models. To inform this Strategy, the NSW Department of Planning, Industry and Environment has provided NARClIM model projections for the Bega Valley for the Present Day (1990-2009), and two future 20-year periods centred around 2030 (Near Future; 2020-2039) and 2070 (Far Future; 2060-2079) for a business-as-usual greenhouse gas emissions scenario, known as SRES A2. The NARClIM climate model data can be accessed via the NSW Government's Climate Data Portal<sup>7</sup>.

## Forest Fire Danger Index

The Forest Fire Danger Index (FFDI) is used in NSW to quantify fire weather. The FFDI combines observations of temperature, humidity and wind speed with an estimate of the fuel state, and ranges from zero to over 150.

Bega Valley Shire does not have a long-term FFDI record available. The closest station in NSW is Nowra (annual average), with a FFDI of 5.6. In the Gippsland region, the annual FFDI at Sale is on average 8.7 at present<sup>8</sup>.

Projections for Bega Valley are for the FFDI to increase by about 15% in the Far Future (2070), but still remain low to moderate. The annual average FFDI is expected to decrease in the Bega Valley Shire by 0.2-0.4 (Near Future) and increase in the Far Future (0.2). Seasonally, the largest increase is expected in Spring (FFDI increasing by approximately 0.5-1.0). The changes in the expected number of days for extreme fire danger is at most 1 additional day over the next 50 years.

## Precipitation

In the south-eastern NSW region, there is a projected future increase in summer and autumn precipitation and decrease in winter and spring precipitation (Table 4). Annual total precipitation is projected to change by 5-15% over the next 50 years, with the largest changes in the eastern half of the Shire.

In the Far Future (2070), the summer becomes increasingly wet, however rainfall changes are projected to be less than Near Future (2030) projections for other seasons due to wet/dry periods and influences of temperature on water vapour.

**Table 4:** The Present Day (1990-2009 average) annual total precipitation and the change in the annual total for the Near Future (2020-2039 average) and Far Future (2060-2079 average).

	Present Day: 2020	Near Future: 2030	Far Future: 2070
Precipitation total annual average (whole Shire)	Approx. 800mm/yr	Up to 8% increase	4 to 16% increase

<sup>7</sup> <https://climatedata.environment.nsw.gov.au/>

<sup>8</sup> Hennessy, K., Lucas, C., Nicholls, N., Bathols, J., Suppiah, R., and Ricketts, J. (2005). "Climate change impacts on fire-weather in south-east Australia." *Climate Impacts Group, CSIRO Atmospheric Research and the Australian Government Bureau of Meteorology, Aspendale*

## Temperature

The annual maximum temperature increases in the Near Future (2030) are highest in summer and spring, and in the Far Future (2070) the increases are highest in winter and spring (Table 5).

The annual minimum temperature increases over the next 50 years are largest in summer, and in the north-western region of the Shire.

**Table 5:** The Present Day (1990-2009 average) maximum and minimum temperature, and the temperature change for the Near Future (2030) and Far Future (2070).

	Present Day: 2000	Near Future: 2030	Far Future: 2070
Max temperature	18-20°C (southern half) to 20-22°C (northern half)	0.2 to 0.5°C increase	1.4 to 2.2°C increase
Min temperature	4°C (northwest inland) to 12°C (southeast coastal)	South of Eden: 0.4°C increase  Most of Bega Shire: 0.6 to 0.8°C increase  Bemboka/rural: 1°C increase	Southern half of Bega Shire: 1.6 to 2.2°C increase  Northern half of Bega Shire: 2 to 2.6°C increase  Bemboka/rural: up to a 2.6°C increase

## Hot days and cold nights

In the Present Day (1990-2009) period, there is only one or two days where the temperature is above 35°C, however this increases by up to 5 days over the next 50 years, with greatest changes inland (Table 6).

There are currently up to 120 cold nights in the Shire (temperatures below 2°C), with the coastal regions experiencing less than 10 cold nights a year, and this number increases north-westward through the Shire. In the future projections, there is a clear decrease in the number of cold nights, with largest decreases found in rural Bega Valley Shire (Table 6).

**Table 6:** The Present Day (1990-2009 average) total number of hot days above 35°C and cold nights below 2°C, and the change in these totals for the Near Future (2020-2039 average) and Far Future (2060-2079 average).

	Present Day: 2000	Near Future: 2030	Far Future: 2070
No. hot days per year (over 35°C)	Approx. 1	Coastal: 1 extra days  Inland: 2 extra days	Coastal: 1 to 3 extra days  Inland: 5 extra days
No. cold nights per year	Coastal: about 10  Inland: up to 120	Coastal: 1 less night  Inland: up to 14 less nights	Coastal: 4 less nights  Inland: up to 28 less nights

## Wind

Table 7 presents results for two wind calculations averaged over the three NARClIM 20-year epochs (Present Day: 1990-2009), Near Future (2020-2039) and Far Future (2060-2079):

- The daily mean wind speed
- The daily maximum wind speed

**Table 7:** Daily mean and Daily maximum wind speed projections Bega Valley Shire

	Present Day: 2000	Near Future: 2030	Far Future: 2070
Daily mean wind speed	Northern central Bega Shire (5m/s) Rest of Shire 5-7m/s	2% Increase (Inland)	8% Increase (Inland)
Daily maximum wind speed	15m/s	5% (Averaged across Shire)	5% (Averaged across Shire)

The Near Future changes are very small due to a balance between increased mean wind speed of approximately 5% in Autumn and Spring, but a similar sized decrease projected for summer and winter. The Far Future, conversely, shows an increase in the mean wind speed that is persistent across the year and strongest in spring (particularly in the northwestern part of the Shire).

In the Near Future, the daily maximum wind speed shows large variation in size and magnitude across seasons. The daily maximum wind speed in the northern half of the Shire is projected to increase (primarily in spring by up to 8%). In the southern half of the Shire, modelling projects minor decreases (less than 4%) for summer and autumn, and minor increases in winter and spring.

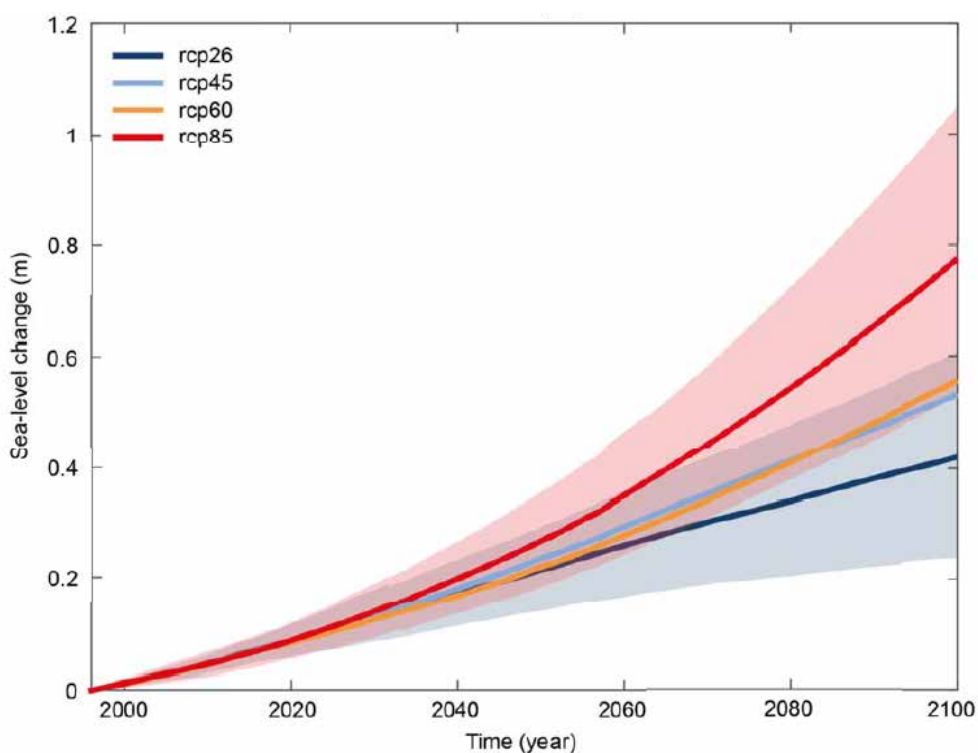
In the Far Future, the daily maximum wind speed increases in the northern half of the Shire (by up to 8%; strongest in spring) and decreases in the southern half of the Shire (less than 4% change).



## Sea level rise

Sea levels are rising globally and around the Australian coastline and will continue to rise through this century and beyond. Consistent with global increases, sea levels have risen in Australia at an average rate of 2.1 mm/year over the past half century.

Projections of sea-level rise for Australia show that the rate of rise during the 21st century will be greater than over the past four decades for all greenhouse gas concentration scenarios (Figure 8). Sea-level rise projections for the Australian coast by the end of the century are similar to the global average. The likely estimate of sea-level rise in Australia by 2100 is about 54-106 cm higher than 1986-2005 levels, depending on the extent of greenhouse gas abatement that is achieved in the near future. The RCP 8.5 pathway or “business as usual” scenario models significant sea level rise for south east Australia (Figure 8). For Bega Valley Shire, this amount of sea level rise would lead to approximately 16km<sup>2</sup> of foreshore land being inundated by the year 2100 and the landward recession of our ocean beaches.



**Figure 8:** NSW Coastline Sea Level Change Projections (OEH, 2016)<sup>7</sup>

<sup>7</sup> Sea Level Rise Science and Synthesis for NSW, NSW Office of Environment and Heritage, 2016



# Policy context

This Strategy represents a local level policy response to broader global and national Climate Change initiatives and greenhouse gas emission reduction targets. Australia is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC). The latest UNFCCC agreement on climate change, the Paris Agreement, binds the Australian Government to achieving the emission reduction targets proposed in the agreement.

## Global policy initiatives

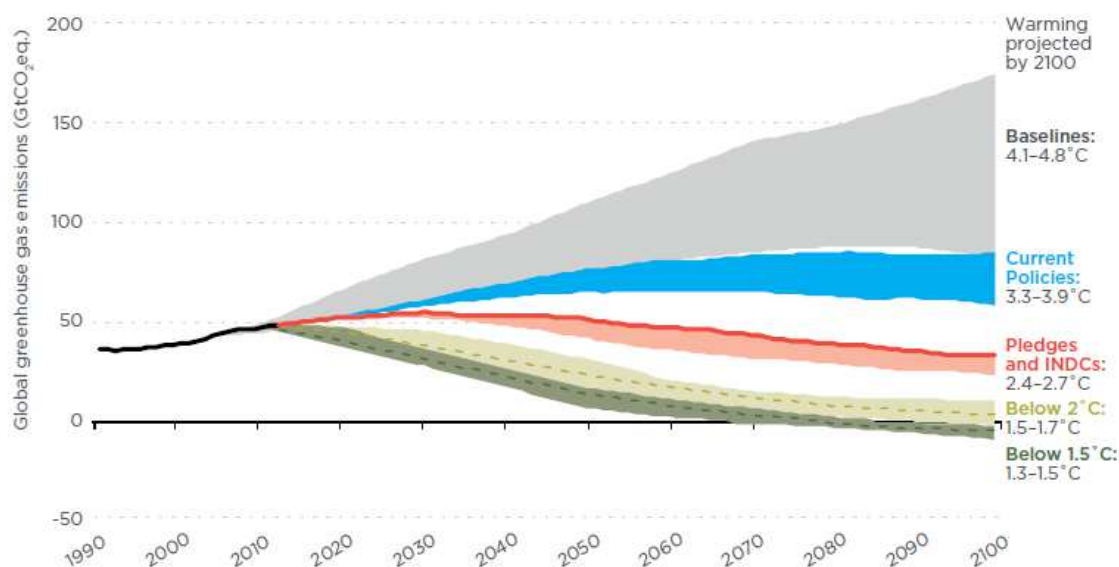
### The Paris Agreement

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the Agreement aims to strengthen the ability of countries to deal with the impacts of climate change.

The Agreement has a number of essential elements of direct relevance to this Strategy including:

- Long-term temperature goal - the Paris Agreement, in seeking to strengthen the global response to climate change, reaffirms the goal of limiting global temperature increase to well below 2°C, while pursuing efforts to limit the increase to 1.5°C ((Figure 9).
- Mitigation – the Agreement establishes binding commitments by all Parties to prepare, communicate and maintain a nationally determined contribution (NDC) to reducing greenhouse gas emissions and to pursue domestic measures to achieve them.
- Sinks and reservoirs –the Paris Agreement also encourages Parties to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gas emissions including forests.

- Adaptation – the Agreement establishes a global goal on adaptation – of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change.
- Climate change education, training, public awareness, public participation and public access to information is also to be enhanced under the Agreement.



**Figure 9:** Range of greenhouse gas emissions with and without climate mitigation measures

## Alignment with the UN Sustainable Development Goals

The Sustainable Development Goals (SDGs) (Figure 10), also known as the Global Goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. Australia is committed to the SDGs as a universal, global approach.

Our local efforts to build a climate resilient community aligns well with the UN SDGs and demonstrates how commitment to implementing global visions require community driven climate responses. The Key Response Areas of the Strategy demonstrate alignment with individual SDGs.



**Figure 10:** The 17 UN Sustainable Development Goals



## The Australian Government Policy Response

The Australian Government has a 2030 target to reduce emissions by 26 to 28 per cent below 2005 levels. This target will see a reduction in the emissions intensity of Australia's economy by two thirds, and emissions per person halve by 2030. On 25 February 2019, the Australian Government announced the Climate Solutions Package, a \$3.5 billion investment to deliver on Australia's 2030 Paris climate commitments. The major elements of the Climate Solutions Fund are;

- Providing a \$2 billion Climate Solutions Fund to reduce greenhouse gases across the economy
- Investment in expansion of the Snowy Mountains Scheme and a second interconnector, Marinus Link, between Victoria and Tasmania
- Household and business energy efficiency improvements
- Developing a National Electric Vehicle Strategy

## The NSW Government Climate Change Policy Framework

The NSW Government endorses the Paris Agreement and will take action that is consistent with the level of effort to achieve Australia's commitments to the Paris Agreement.<sup>7</sup> The NSW Government's 'Climate Change Policy Framework' sets out its policy response to climate change through emission reduction and broader adaptation actions. The Framework has the stated aim to;

"Maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change."

The NSW Government has two aspirational long-term objectives;

- Achieve net-zero emissions by 2050
- NSW is more resilient to a changing climate

### Enabling adaptation in the South East (EASE)

Using the NSW South East region as a pilot, EASE builds on the findings from the South East Integrated Regional Vulnerability Assessment (SE IRVA) (OEH 2012), to provide a collective evidence base for NSW and local governments to incorporate climate change considerations into long-term planning.

The EASE project was initiated by the former NSW Office of Environment and Heritage (OEH) with the Institute for Sustainable Futures, UTS as a research partner. The project identifies potential transitions for key regional systems and puts them into the context of the vulnerabilities identified by the SE IRVA, projected population change, recent employment trends within industries for the region, and the influence of the neighbouring ACT.

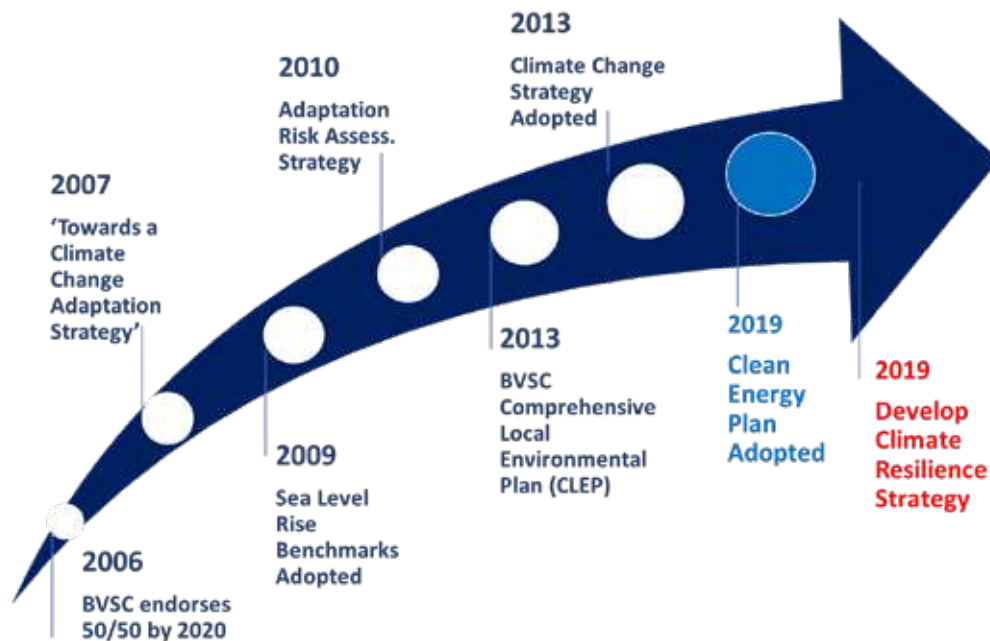
EASE outlines current adaptation planning in our region and concludes by describing some possible first steps Enabling Adaptation in the South East (EASE) aims to "use tacit local knowledge to identify regional climate vulnerabilities and develop workable and agreed pathways and projects that minimise the impacts of climate change on local communities and build resilience to future extreme events and hazards."

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<sup>7</sup> NSW Government Climate Policy Framework 2016

## Local policy and action

This Strategy draws together and builds upon current climate change initiatives across Bega Valley Shire to create a unified approach to climate change and broader sustainability objectives. Bega Valley Shire Council has been undertaking climate change mitigation and adaptation action since 2007 and has embedded consideration of climate resilience throughout all parts the organization (Figure 11).



**Figure 11:** BVSC Climate Change Response timeline

This Strategy recognises that there has been an extensive body of work already undertaken with regard climate change response in the Shire. The Strategy will support and evolve with interconnected strategies from all levels of government and industry and reinforce existing programs, as well as key community and industry networks.

Appendix 2 identifies a number of key programs and documents that have strategies and actions relating to adapting to the realities of a changing climate or suggest mitigation projects to limit our Shire's contribution to future climate change impacts.

Local climate change mitigation and renewable energy transition has been championed by Clean Energy for Eternity (CEFE), a local community-based group that has supported a wide range of mitigation, renewable energy, education and advocacy activities throughout the Bega Valley Shire, in neighbouring regions and at locations across Australia. Their activities have seen the installation of solar arrays on local community facilities, including their award winning 'Imagine Solar Farm' in partnership with Bega Valley Shire.

Rooftop solar has been extremely popular with over 25% of local private houses having solar installations. Numerous large and small scale commercial and industrial premises, farm buildings and Government buildings also have solar systems installed further increasing the Shire's renewable energy capacity.



# Climate resilience risk assessment

This following section examines the risk to the resilience of the Bega Valley Shire, its environment, economy and community that may arise from the impact of climate change. Key vulnerabilities identified across the Shire are analysed against six key climate change related impacts predicted to affect the Bega Valley Shire (Appendix 3);

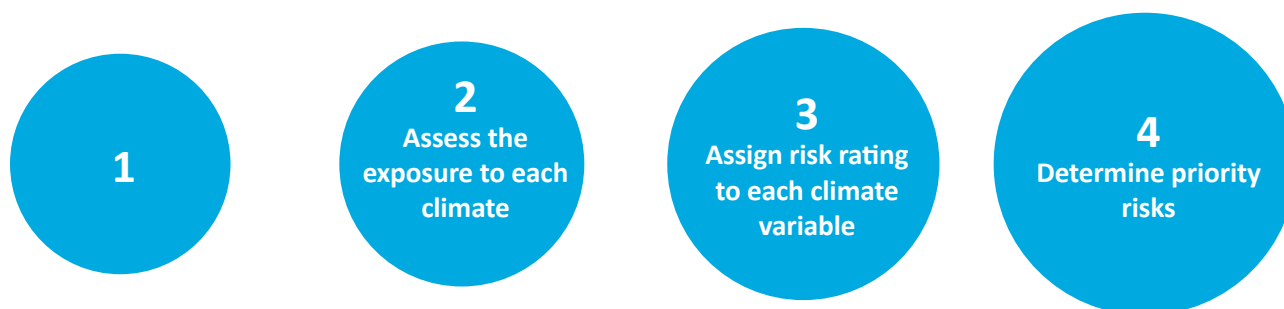
- Sea level rise
- Rainfall variability
- Increase in average temperatures
- Increased number hot days (35 +)
- More intense storms
- Change in ocean temperature and acidity

The risks identified in Appendix 3, relate only to climate change impacts and does not consider other contemporary physical, environmental, socio-economic or political factors that may impact on the various vulnerabilities that have been identified. As such many important vulnerabilities and issues receive a low risk scoring from a climate impact point of view. These issues are addressed by other strategic and policy initiatives by Council or other Government agencies.

Determining the climate resilience risk for individual vulnerability factors is essentially being able to address the risk and increase the Shire's resilience to climate change. The higher the climate risk to a particular vulnerability, the higher the priority for undertaking action to increase our resilience to a changing climate.



The process for assessing the impact of individual climate variables on individual vulnerability factors and determining a cumulative climate resilience risk rating is illustrated in Figure 12.



Vulnerability Factor	Climate Variable (6 x Variables)	Climate Variable Individual Resilience Risk (Exposure / Sensitivity)	Risk Rating	Averaged Climate Resilience Risk Rating
Example; Estuary Ecosystem Health	Example: Rainfall variability	5	Extreme	4.5 - 5
		4	High	3.5 - 4.4
		2-3	Moderate	2 – 3.4
		0-1	Low	0 – 1.9

**Figure 12:** Climate resilience risk assessment

## Our key existing vulnerabilities

The following section provides a brief overview of the Shire’s existing vulnerabilities across a range of sectors (see full analysis in Appendix 4)

Bega Valley Shire’s size, topography and landscape diversity bring with it a range of vulnerabilities to natural hazards and future climate variability. Encompassing 6,279km<sup>2</sup>, the Shire spans a range of environments from the eastern Monaro, escarpment forests, river valleys, coastal catchments and a 225km long coastline (Figure 13). These physical characteristics in combination with our settlement distribution, infrastructure network, community and social characteristics and economy result in the Shire having a range of vulnerabilities to future shocks and ongoing stressors.

## Natural systems

Our community highly values the quality of our local environment and consistently rates our environmental management activities as the most important function provided by Council. The high quality of our natural systems underpins our tourist, aquaculture, fishing and agricultural sectors. As such addressing vulnerabilities and threats to our natural systems are a key focus of Council and other natural resource management agencies.

The geographic and topographic distribution of our key natural systems from the forests of the escarpment and coastal ranges, floodplain wetlands of the Bega and Towamba Rivers, 28 estuaries and 225km long coastline, means that they have a range of vulnerabilities to ongoing pressures and shocks. These vulnerabilities result in all our natural systems having a high exposure to climate change.

The health and resilience of our natural systems is a key priority of this strategy as the universal factor essential to resilience across all sectors. The effective management of our natural systems will not only increase our communities' resilience, it will reinforce our "natural advantage" over other coastal destinations.

### Key Vulnerabilities: Natural Systems

Decline in tree canopy cover

Fragmentation of wildlife corridors

Biodiversity – threatened species

Biodiversity – Invasive species (flora)

Biodiversity – Invasive species (fauna)

Length of coastline

Length of estuarine foreshore

Estuary ecosystem health

Lack of riparian vegetation

Extent of dune systems



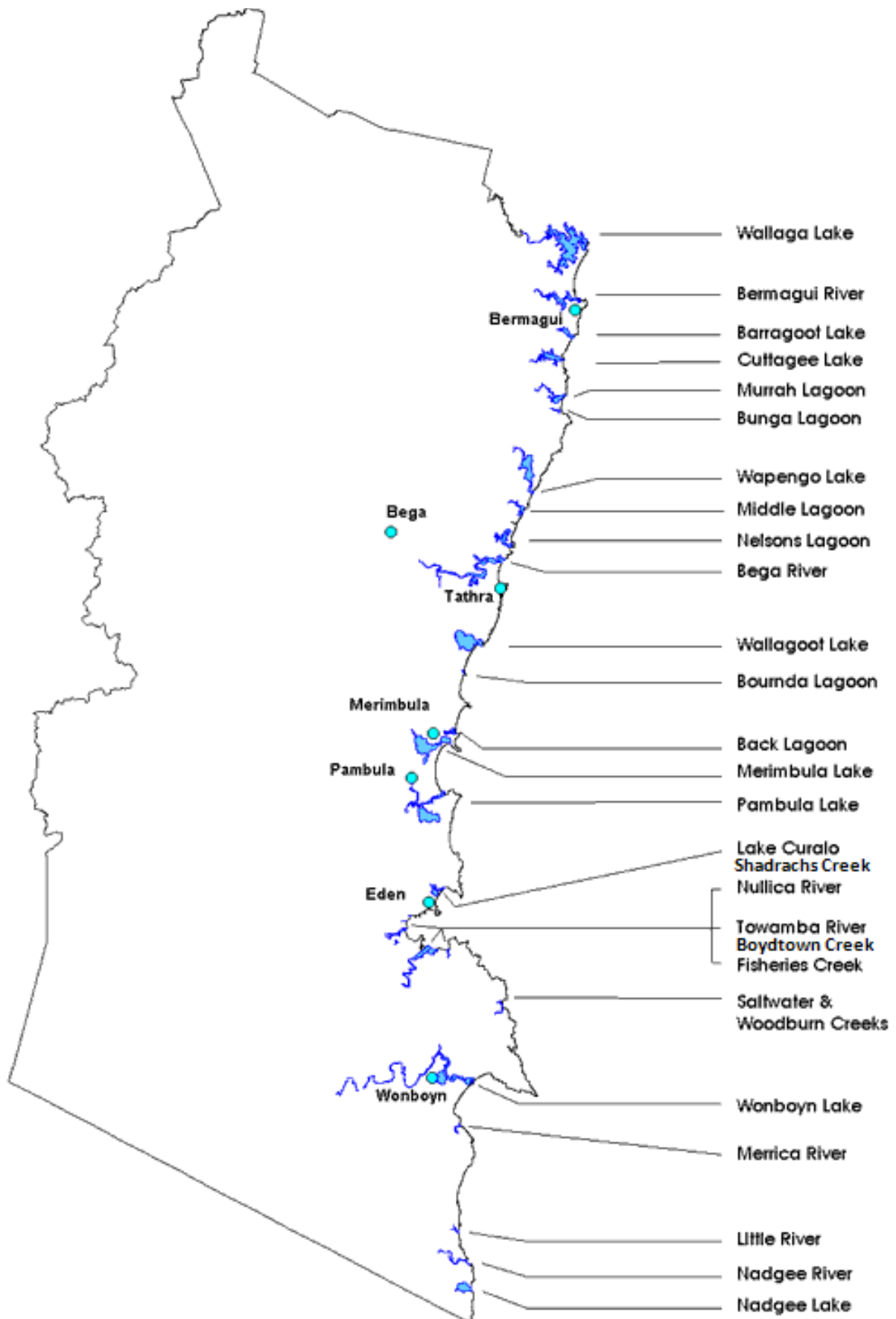


Figure 13: Bega Valley Shire Estuaries



## Land use and settlement

Approximately 70% of our Shire is owned and managed by the NSW Government (National Parks, State Forests, Crown Land are the major land owners) (Table 8). These areas have a range of vulnerabilities over which Council has limited influence or direct management responsibility. The majority of these areas are under forest cover of varying types, making them vulnerable to climate impacts as discussed in the previous section and later in this strategy.

Our major land uses have a range of interconnected existing vulnerabilities that make them particularly susceptible to a changing climate. When combined, our forested areas (NPWS, State Forest and Private) and agricultural areas represent 93% of land use in the Shire. These areas are acutely vulnerable to changing rainfall patterns, drought and the risk of bushfire.

The geographic distribution of our towns, villages and rural population, not only poses a significant infrastructure management challenge for Council, but results in various social and economic challenges for our residents and service providers. The distance between settlements and key services, facilities, combined with a lack of public transport, places a heavy reliance on private motorised transport.

Table 8 – Bega Valley Shire Land Use Breakdown

Land use	Percentage of Shire
National Park	40%
State Forest	26%
Rural	27%
Residential / Commercial / Industrial / Environmental / Recreation	6%
Estuaries and waterbodies	1%

### Key Vulnerabilities: Land use and Settlement

Area of Shire within NP or State Forests

Extent / location of agricultural land

Distribution / location of towns, villages and settlements

Location of rural residential development

Low lying development

Length of bushland / urban interface

Lack of connectivity between and within settlements

Vehicle dependence

Lack of public transport

Limited housing diversity

Reliance on major towns for essential services



## Infrastructure

One of our community's greatest existing vulnerabilities is the extent of our infrastructure network, to service what is a relatively small population base. Due to the Shire's land use, topography and distribution of settlements, the road, water, sewage and electricity infrastructure network in particular is extensive and linear in nature (Table 9).

Apart from the financial implications for our community in being able to fund this infrastructure network, the extent and linear network make it susceptible to impact from operational breakdowns, natural hazards such as flood, bushfire or storms or climate extremes such as prolonged heatwaves.

Table 9 – Extent of key asset types across the Shire

Asset Type	Length / number
Bitumen Roads	745
Gravel Roads	706
Bridges	227
Water pipeline major	235km
Water pump stations	37
Sewer rising mains	231
Reticulation sewerage mains	347
Sewage pump stations	1,051
Sub Transmission powerlines	332km
Distribution powerlines	1954km
Low voltage powerlines	1155km
Zone Substations (major)	6
Number of substations/ transformers	3329 +

### Key Vulnerabilities: Infrastructure

Extent of bitumen road network
Extent of gravel road network
Low lying water and sewer infrastructure
Location of airport
Water supply system
Capacity of stormwater network
Linear power network
Council's asset portfolio
Telecommunication infrastructure
Distribution of recreational assets
Condition of major highways
Number of bridges and culverts
Management of waste products



## Economy

Our local economy has a low diversity of major industry sectors and is reliant on agricultural, manufacturing, freight transport, tourism and medical /health sectors (Figure 14). The majority of these sectors have a high vulnerability to ongoing socio-economic stressors and acute shocks such as natural disaster, industry restructure or political / policy changes.

The majority of these key vulnerabilities also have a reliance on our natural systems, natural resource consumption or climatic variables. This reliance increases these industry sector exposures to the impacts of a changing climate.

Key Vulnerabilities: Economy
Lack of industry diversity
Reliance on major employers including Gov.
Dairy – water access
Dairy – irrigation costs
Dairy – production costs /commodity prices
Beef – commodity prices
Tourism - seasonality
Tourism – market competition
Tourism - reliance on natural environment
Distance from markets
Reliance on external food and commodities
Reliance on external energy production
Aquaculture – ecosystem health
Internet access / quality
Online shopping / changing retail trends
Reliance on road transportation

## Jobs

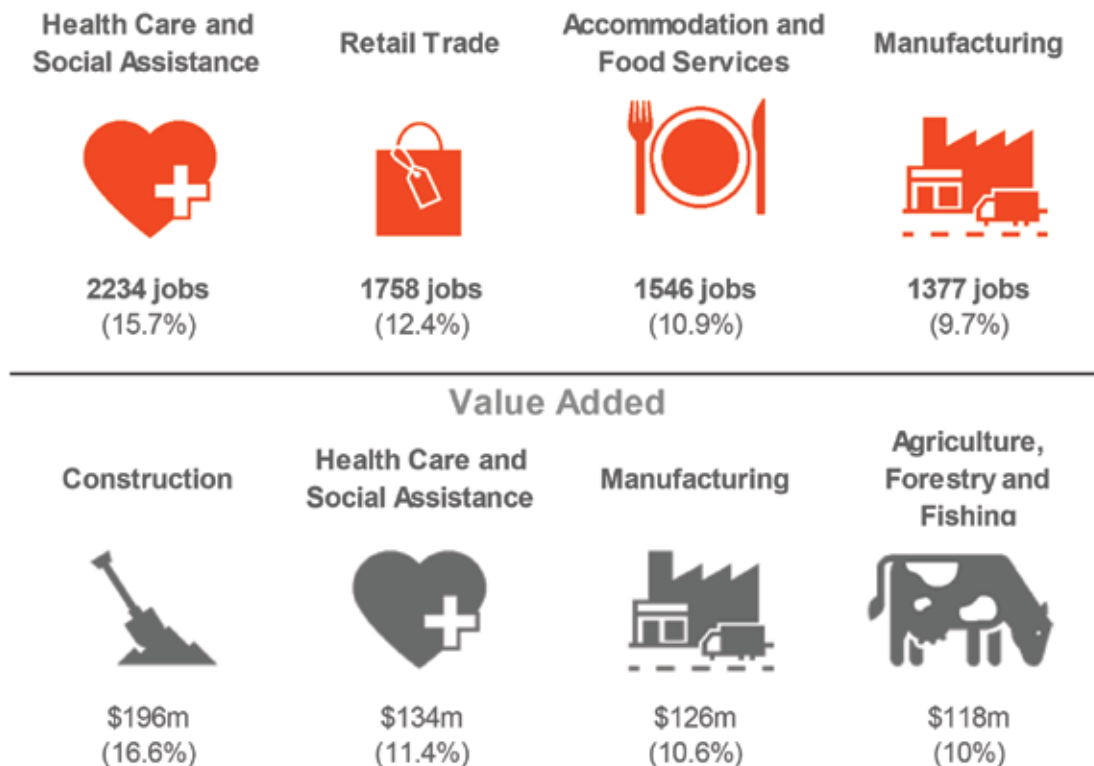


Figure 14: top four Bega Valley Shire Council industries for employment and value

Source: NIEIR



## Our community

The health and wellbeing of residents is an important indicator of the quality of life experienced by our community as a whole and can affect the ability of residents to participate in community life.

Factors that impact on our community's wellbeing and are key vulnerabilities are primarily socio-economic conditions (Figure 15) that residents experience, housing access / affordability, access to education, transport and sustainable employment opportunities.

Healthy built and natural environments are also key aspects in supporting individual and community wellbeing, living amenity, lifestyle and underpin resilience

### Key Vulnerabilities: Our Community

Ageing population
Limited education & training opportunities
Limited employment opportunities
Availability of specialist medical services
Absentee property owners
Rates of volunteerism
Reliance on social and community networks
Lack of cultural diversity
Housing affordability
Income inequality
Integration of new residents
Cost of living pressures
Disability services
Long term knowledge and skill availability

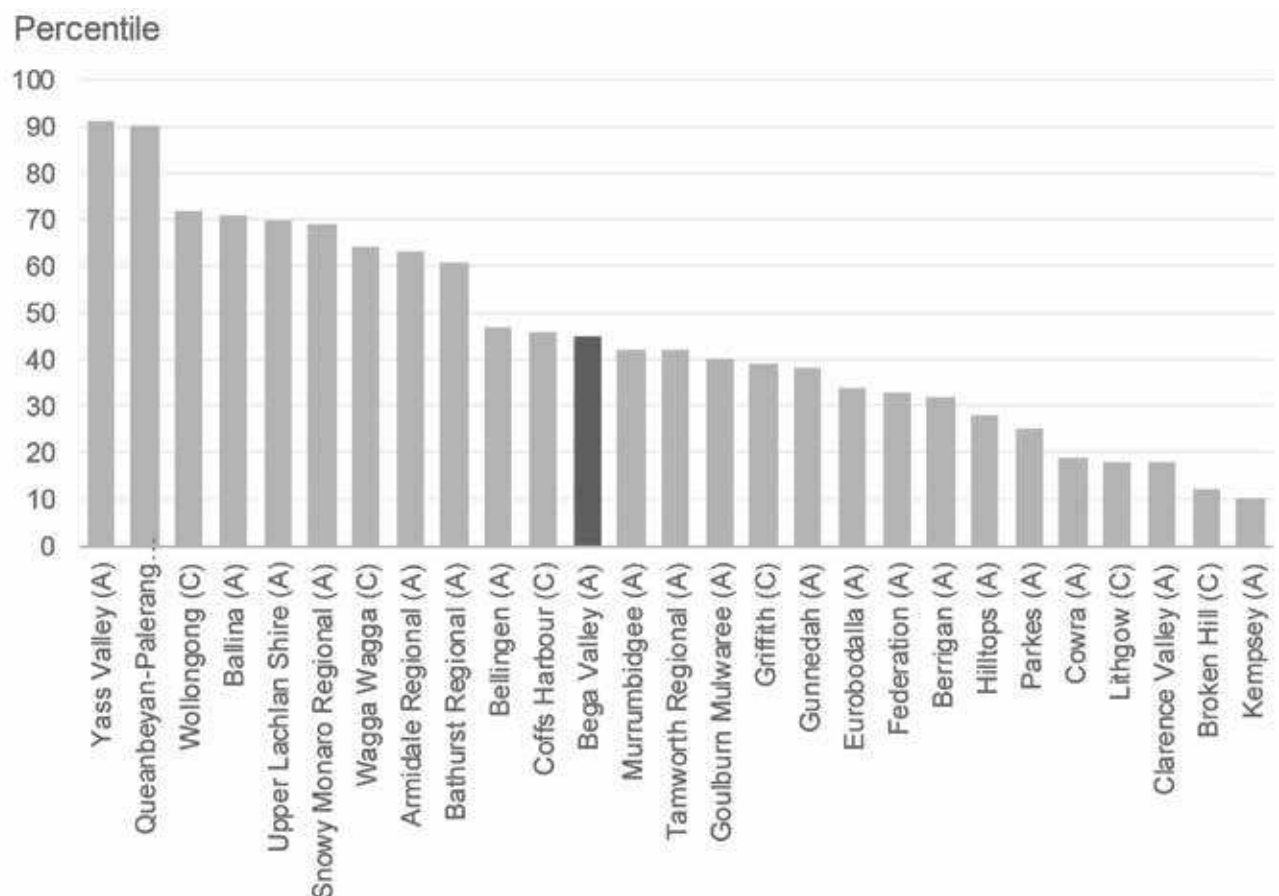


Figure 15 – SEIFA relative socio-economic advantage and disadvantage index

## Climate resilience – high risk summary

The extreme and high risks identified in Appendix 3 are shown in Table 10.

**Table 10:** Extreme and High Climate Resilience Risks

	Vulnerability	Climate Resilience Risk Priority	Level of Council Influence
Risk 1	Estuary ecosystem health	High	Direct
Risk 2	Lack of riparian vegetation	High	Direct
Risk 3	Extent of dune systems	High	Direct
Risk 4	Extent / location of agricultural land	High	Indirect
Risk 5	Distribution / location of towns, villages and settlements	High	Indirect
Risk 6	Length of bushland / urban interface	Extreme	Direct
Risk 7	Vehicle dependence	High	Indirect
Risk 8	Low lying water and sewer infrastructure	High	Direct
Risk 9	Telecommunication infrastructure	High	Indirect
Risk 10	Extent of gravel road network	High	Direct
Risk 11	Dairy – water access	High	Indirect
Risk 12	Dairy – irrigation costs	High	Indirect
Risk 13	Dairy – production costs /commodity prices	Extreme	Indirect
Risk 14	Beef – commodity prices	High	Indirect
Risk 15	Tourism - seasonality	High	Indirect
Risk 16	Tourism - reliance on natural env.	High	Direct
Risk 17	Reliance on external food and commodities	High	Indirect
Risk 18	Reliance on external energy production	High	Indirect
Risk 19	Aquaculture – ecosystem health	Extreme	Indirect
Risk 20	Ageing population	High	Indirect
Risk 21	Rates of volunteerism	High	Indirect

A photograph of three children jumping in a water feature in a park. The child on the left is a boy with blonde hair, wearing a white t-shirt and green shorts. The child in the middle is a boy with dark hair, wearing a white t-shirt and black shorts. The child on the right is a girl with curly brown hair, wearing a white long-sleeved shirt and blue jeans. They are all smiling and have their arms raised. The background shows large green trees and a building with a sign that says 'library'.

# The Climate Resilience Strategy

The Strategy establishes the overarching framework for the continued implementation of existing climate resilience mitigation adaptation actions and the pursuit of new initiatives that fill existing gaps in our community's climate resilience.

The Strategy groups climate resilience actions into eight Key Response Areas (Figure 16).

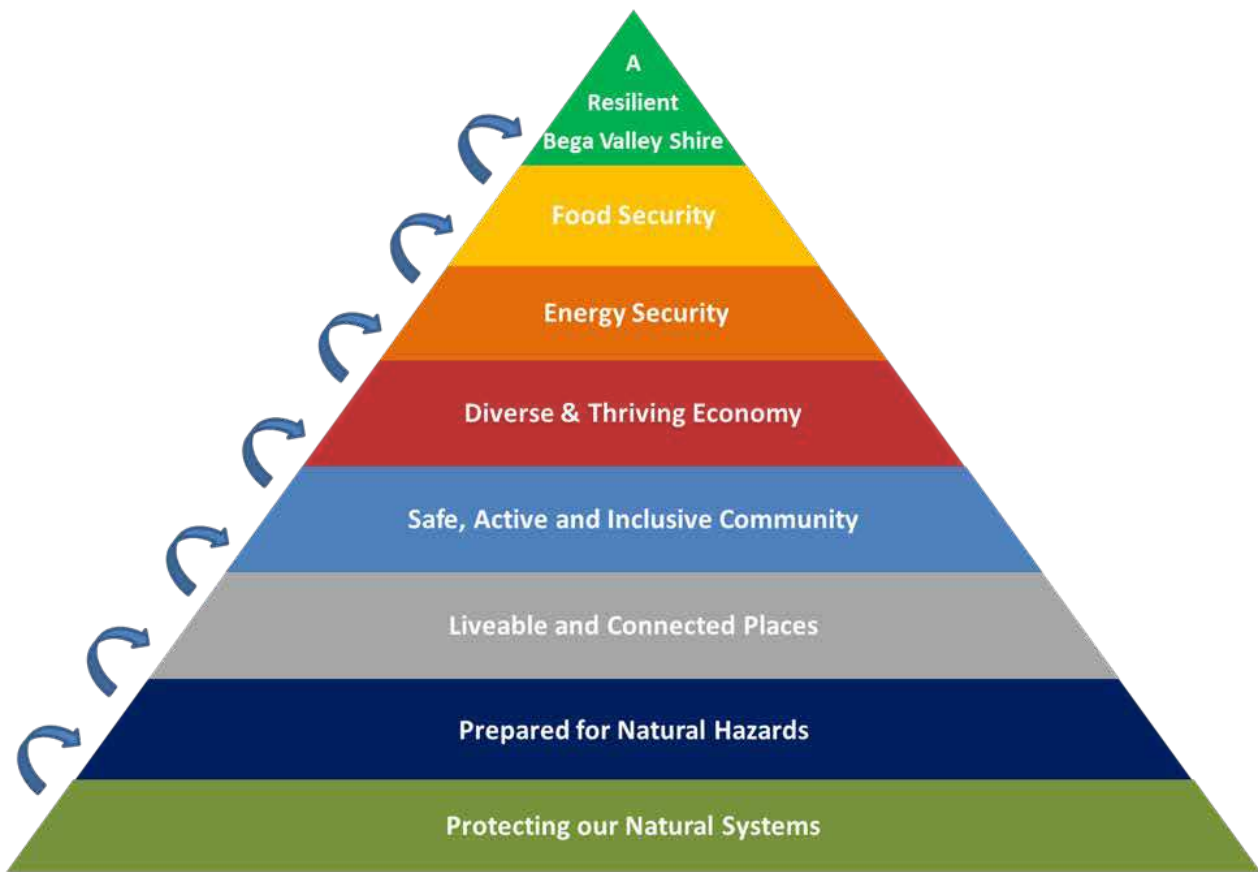
1. Natural Systems
2. Preparing for Natural Hazards
3. Liveable and Connected Places
4. Safe, Healthy and Inclusive Community
5. Diverse and Thriving Economy
6. Energy Security
7. Food Security

Each Key Response Area identifies relevant vulnerabilities, challenges and benefits, describes existing programs, and proposes mitigation and adaptation actions.

The individual resilience initiatives do not operate in isolation, they are a collective set of actions, interlinked across Key Response Areas. For example, actions to protect estuary health have resilience benefits to multiple Key Response Areas including Natural Systems – Coasts and Marine, Thriving and Diverse Economy – Aquaculture / Tourism and Liveable and Connected Places.

Achieving climate resilience in individual Key Response Areas is vital for subsequent Key Response Areas. Each layer of the resilience pyramid cumulatively contribute to a resilient Shire.





**Figure 16:** Bega Valley Shire Resilience Pyramid

## Mitigation and adaptation

Climate change strategies have traditionally been delivered through a suite of mitigation and adaptation actions. This Strategy aims to build the Shire's overall resilience capacity that place Council and the wider community in a stronger position to be able to implement mitigation and adaptation. Each climate resilience action is identified as being a mitigation or adaptation action. In some case they can have both mitigation and adaptation benefits.

### Mitigation

Climate change mitigation refers to direct action to reduce emissions of greenhouse gases and decrease the severity of climate change. The more greenhouse gases that are emitted (both presently and in the future) the greater the scale of future climate change and associated impacts.

### Adaptation

Climate change adaptation refers to changes in human or natural systems in response to actual or expected climate changes in order to minimise impacts or increase beneficial opportunities.

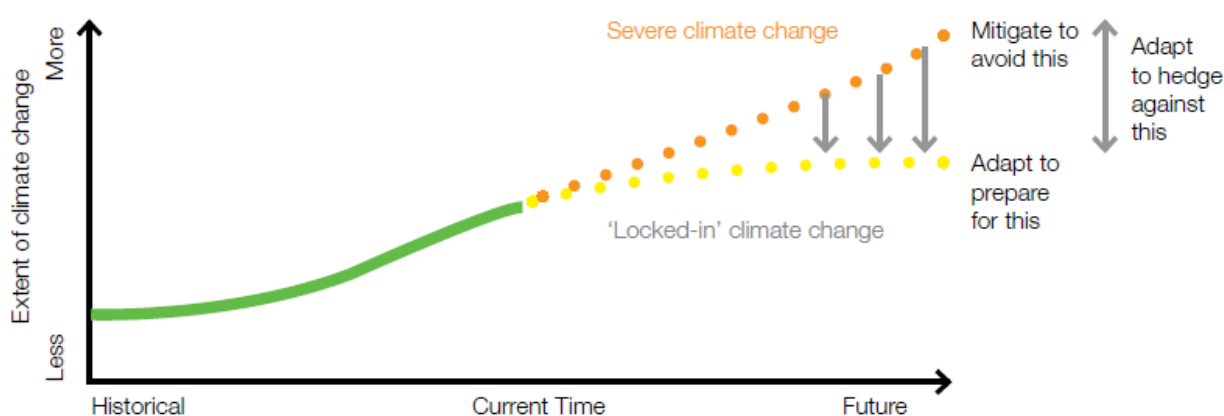
The greater the degree of proactive adaptation that occurs in expectation of specific climate change impacts, the less impact that climate change will have on human and/ or natural systems i.e. the expected climate change will still occur but the impact is expected to be reduced.

## Relationship between mitigation and adaptation

While mitigation addresses the causes of climate change, adaptation addresses the effects of climate change. There is a level of inter-relationship between mitigation and adaptation. The more mitigation that occurs i.e. reduction of emissions, the less severe the climate change and the less adaptation will be required (Figure 17).

Bega Valley Shire has been undertaking adaptation policy, strategy and on-ground adaptation initiatives to address the predicted impacts of unavoidable climate change. We have also been doing our part to reduce emissions and hence minimise the severity of climate change.

While adaptation and mitigation have two distinct purposes, single strategies can address both mitigation and adaptation. For example the installation of solar arrays contributes to a reduction in the Shire's greenhouse gas emissions (i.e. mitigation), whilst also making the Shire more resilient to future energy price increases.



**Figure 17:** Relationship between mitigation and adaptation

## Solution multipliers

Climate change has been identified as a threat multiplier by several international agencies such as the US Department of Defence, United Nations Security Council and NATO. Climate change can exacerbate existing threats such as severe drought, severe storms and heat stress and may result in crop failure, mass migration or political upheaval.

Conversely this Strategy identifies a number of “solution multipliers”, or natural assets of the Shire, that provide multiple climate change resilience benefits over and above their primary ecosystem or physical function. These natural assets have the added benefit of already being in our landscape and requiring little management intervention or enhancement. As such they present low cost and resource efficient ways in which we can strengthen our resilience and provide a foundation to address our climate resilience challenges across all sectors (see Table 11 for examples).

**Table 11** – Contribution of natural assets to climate resilience.

Natural Asset	Key Ecological or other Function	Additional Climate Resilience Value
Wetlands	Habitat, water filtering, sediment deposition	Carbon sequestration, storm surge buffer
Mangrove	Habitat, sediment deposition	Carbon sequestration, foreshore stabilisation
Dune Systems	Habitat, sediment storage	Open coast recession buffer, storm bite erosion buffer
Forest	Habitat, oxygen production, catchment protection, timber production	Carbon sequestration, localised temperature moderation
Grasslands	Habitat, agricultural production, catchment protection	Carbon sequestration, reduction in transpiration
Oyster reefs	Habitat, food source	Storm surge buffer, foreshore erosion buffer, increase in height with sea level
Catchments	Habitat, Water supply	Carbon sequestration, buffer intense rainfall events
Street Trees / Parks and Reserves	Habitat, shade, amenity	Reduction of urban temperature, carbon sequestration, shade relief





## Council / community partnership – the key to success

This Strategy is a key document that will help set our Shire up to be a safer place in an uncertain future and will help us to cope with the challenges that climate change may bring. For this Strategy to be successful in creating a climate resilient Bega Valley Shire, it is vital that we work closely together as a community.

Council has a critical leadership role, facilitating, coordinating and catalysing actions to see the successful implementation of this plan. Delivering all these actions depends on partnerships between Council other government agencies, industry, not-for-profit groups, and individuals across the Shire.

This Strategy will require changes in thinking and approach across all sectors of our community. It is important that opposing views are heard and considered, but these cannot delay the timely response to taking action to boost the Shire's resilience.

“I believe we will require a series of ‘resilience conversations’ on selected topics, with the intent of bringing community members accessible information on climate resilience and its benefits. This process will in turn require a consensus approach where we can all come to pretty much agreed positions on issues like bush fire risk and how to deal with it, water security, storm surge, biodiversity, etc.” - BVSC Climate Technical Panel Member

It is critical that the conversations across our community and with Council does not become polarised and instead focus on the risks that climate change will likely bring (while acknowledging uncertainty about exactly when those risks will occur), and making the case that these risks can be better managed if we start acting now.



# Strategy implementation

Implementation of the individual actions will be driven by the responsible agency identified against each action. Council’s priorities will be based on responding to high climate resilience risks as listed in the previous section and driven through our Integrated, Planning and Reporting Process, specifically the annual Operational Plan. Opportunities for grants from other tiers of government will also be sought to assist in the delivery of the required actions. Community partnership arrangements will also be pursued.

For each action a timeframe for implementation and likely cost of action are identified (see key below), as well as the responsibility for delivering the action (see list of acronyms for organization names).

Implementation Timeframe	Indicative Implementation Cost
Ongoing	- Nil
Short 2020 - 2025	- Low
Medium 2025 - 2030	- Medium
Long term 2031 - 2050	- High

# Natural Systems – Coast and Marine

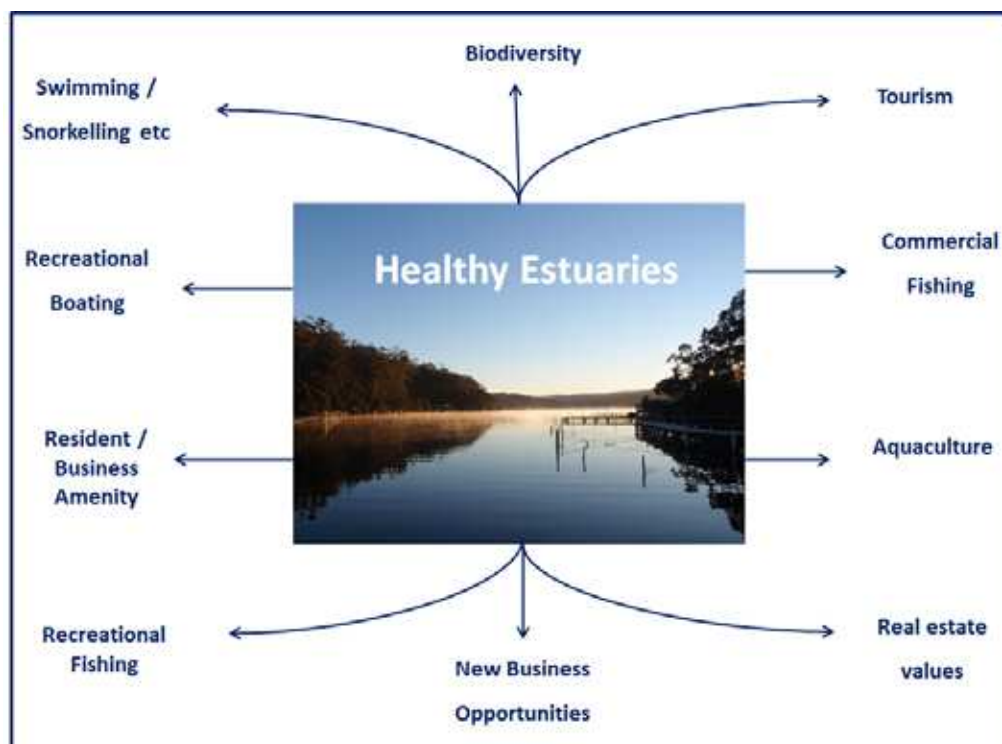


## Climate Resilience Challenges

Five of the Shire's six major settlements occur in the coastal zone and 50% of the Shire's population lives within 1.5km of the coast. Forty-five percent of the Shire's population lives adjacent to only 10 percent of our coastline, focusing pressures on a limited number of our beach and estuarine environments.

This population concentration, when combined with seasonal tourist and local visitor usage, places pressure on our coastal environment, that will have to be carefully managed into the future to ensure one of the premier "natural advantages" is protected.

The marine environment of the Bega Valley Shire sees the meeting of two major bioregions; the Batemans Shelf and Twofold Shelf Bioregions. These areas meet off the coast of Tathra and are the focus of scientific research into the impacts of climate change on marine ecosystems, changes in ocean temperature and ocean currents, due to the global significance with regard their diversity of geomorphology, ecology and ecosystem health (Figure 18) .



**Figure 18:** Healthy Estuaries Ecosystem Services

The East Australian Current is now penetrating further south along our coastline, resulting in warmer offshore ocean temperatures and increasing sightings of tropical species beyond their normal range and a southern retraction of bull kelp forests. These changes to current and temperature have the potential to result in dramatic changes in species distribution, diversity and the abundance of key target commercial species.



Rising sea levels are a key climate impact risk for our saltmarsh and wetland areas and their ability to migrate with higher estuarine water levels. The existing foreshore land forms (cliff, rocky shore, gentle slopes, floodplains) and land use (urban, open space or farmland) will determine whether these vital ecosystems can migrate, avoid being “squeezed out” and continue to provide their vital ecosystem services. Increasing estuarine water temperatures and changes to water chemistry, will be a major stressor on the sustainability of foreshore wetlands, seagrass and saltmarsh areas.

The protection of our dune systems has long been a key adaptation focus for Council and agencies such as LLS (CMA, DLWC) and our local land care groups in Tathra, Bermagui and Merimbula. Our dune systems are our primary defence to the impacts of coastal erosion events such as the 2016 east coast low, providing a substantial buffer between the storm waves and public and private assets. Rising sea levels increase the potential for increased foreshore recession (in the absence of sediment supplies) and the need for robust dune systems.

### Climate Resilience Benefits

- ✓ Multi - benefit from natural system-based solutions
- ✓ Low cost adaptation and mitigation actions
- ✓ Estuarine Health
- ✓ Support resilience of industries based on natural resource use (Aquaculture, Fishing, Abalone)
- ✓ Protect Recreational amenity
- ✓ Carbon sequestration
- ✓ Coastal erosion buffer
- ✓ Species diversity
- ✓ Habitat protection

## Natural Systems – Coast and Marine

Performance Measures and Targets	<ul style="list-style-type: none"> <li>• Increase in area of wetland protected</li> <li>• Increase in estuarine health</li> </ul>
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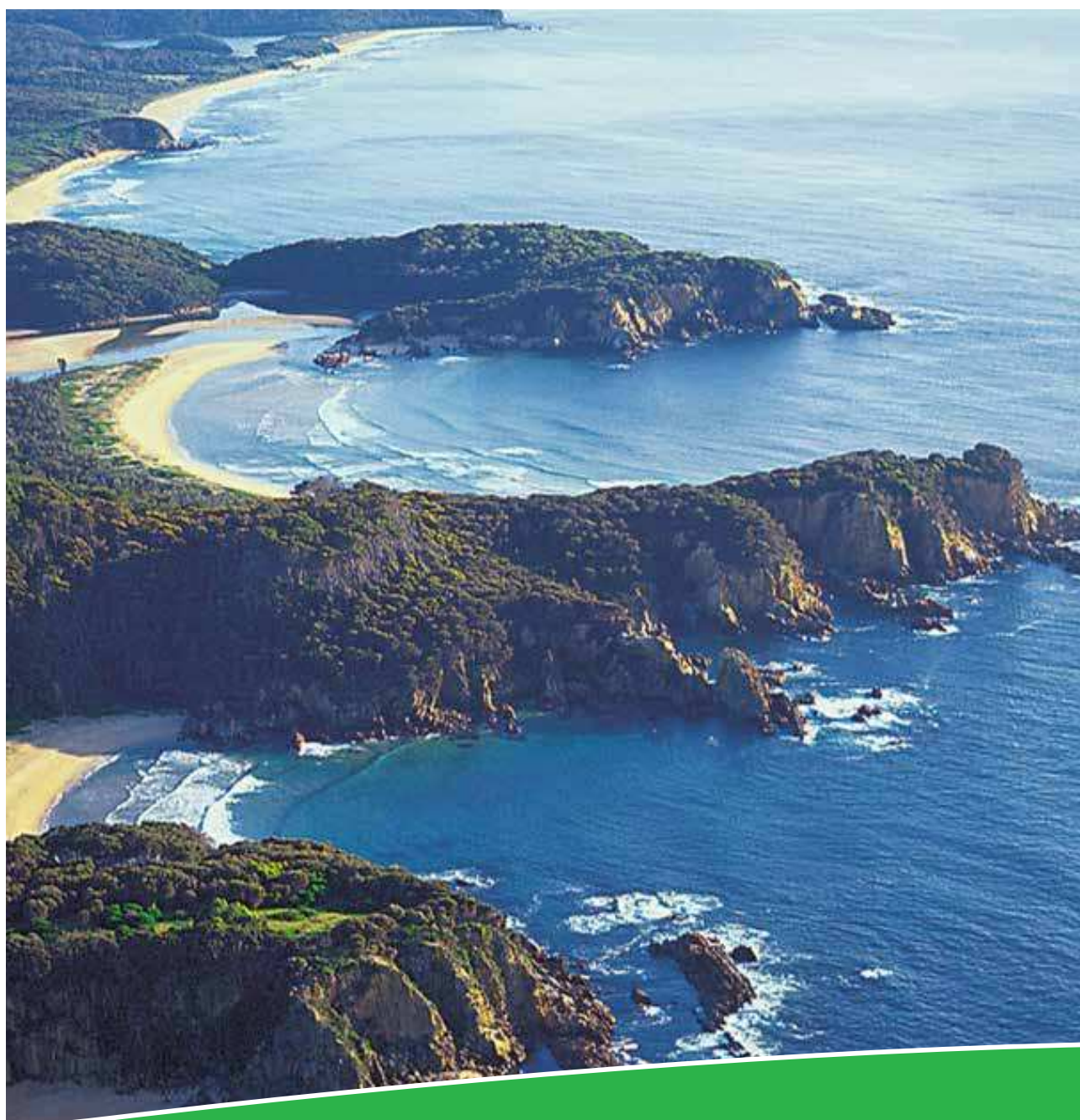
Climate Resilience Projects / Programs	Risks	Mitigation	Adaptation	Lead
Wallaga Lake, Bermagui River, Merimbula and Back Lake, Lake Curalo Coastal Management Programs	R1, R2, R16	✓	✓	BVSC, DPIE
Marine Estate Management Strategy	R1, R2, R3 R16, R19	✓	✓	DPI
Love Our Lakes Program	R1, R19		✓	BVSC, IND
BVS Dune Protection and Management Program.	R3		✓	BVSC
Wapengo, Middle Lagoon, Cuttagee and Baragoot Rapid Catchment Assessments	R1, R2		✓	BVSC
BVS Estuary Entrance Management Policy	R1, R8		✓	BVSC
Bega River Estuary Management Plan	R1, R2, R8, R12, R16	✓	✓	BVSC, DPIE, DPI
Pambula Lake Coastal Management Plan	R1, R2, R8, R19	✓	✓	BVSC, DPIE, DPI, IND
Community Environment Grants	R1, R2, R3	✓	✓	BVSC

Climate Resilience Actions	Risks	Mitigation	Adaptation	Lead	Timeframe	Cost
Expand dune protection and revegetation program across the Shire, with a key focus on Bermagui, Tathra, Merimbula, Pambula and Aslings Beaches	R1, R16		✓	BVSC, LLS	Short	Med
Identify critical wetlands, saltmarsh on private land and develop incentives for protection of these areas	R1, R2	✓	✓	BVSC, DPI, LLS, COM	Short	Low
Identify strategic migration sites for wetlands, saltmarsh and mangrove communities	R1, R2	✓	✓	BVSC, LLS, DPI,	Short	Low

Climate Resilience Actions	Risks	Mitigation	Adaptation	Lead	Timeframe	Cost
Specific estuarine health monitoring programs targeted at high risk estuaries	R1		✓	BVSC, DPI,	Ongoing	Low
Species diversity and abundance surveys of estuaries and key marine indicator species	R1		✓	DPI	Ongoing	Low
Monitor changes in marine algae diversity and distribution as key indicator of changes to near shore ocean temperatures and current penetration.	R1		✓	DPI	Ongoing	Low
Undertake community engagement activities to increase awareness of local natural values.	R1	✓	✓	BVSC, DPI	Short	Low
Undertake oyster reef restoration trials	R1		✓	DPI, LLS	short	Low
Strategic sand pumping in Bega River Estuary to improve flushing of Mogareeka, Black Ada and Racecourse creek sections of the estuary.	R16		✓	BVSC, IND	Short	Med
Investigate and protect key areas of the landscape where natural processes can be enhanced and optimised (sediment compartment) to protect and adapt to sea level rise and inundation.	R1, R3, R16, R19	✓	✓	BVSC, LLS	Medium	Med
Review planning provisions including zonings through a climate resilience framework to ensure vulnerable landscape are adequately protected	R1, R4, R5, R6, R19		✓	BVSC	Short	Low



Climate Resilience Actions	Risks	Mitigation	Adaptation	Lead	Timeframe	Cost
Investigate opportunities on Council owned land to develop and undertake flagship on-ground climate resilience projects, including offsetting sites.	R1, R2, R3		✓	BVSC	Short	Low
Collaborate and partner with research institutions to investigate opportunities for climate resilience research on existing or new projects.	R11-R20	✓	✓	BVSC, UNI	Ongoing	Low



# Natural Systems – Catchments and Forests



## Climate Resilience Challenges

Bega Valley Shire has three major river catchments, the Bega, Brogo and Towamba River systems. These catchments supply all the Shire's urban and village water supplies and are home to the majority of the Shire's agricultural industry. The Narrira Creek catchment and part of the Tuross River catchment encompasses the Cobargo, Wandella and Yowrie agricultural areas. All the catchments have been heavily modified, with most drainage lines being heavily incised, suffering varying degrees of erosion and sedimentation.

The protection of our upland swamps and floodplain wetlands are of vital importance in retaining water in our catchments and moderating runoff from intense rainfall events. The restoration of our catchment areas to achieve greater natural system water storage, riparian revegetation and improved soil moisture retention is one of the greatest challenges in increasing our resilience to potential climate impacts.

Our forest areas provide a range of values including ecological, catchment protection, carbon sinks, forest products and tourism. Some of them are uniquely evolved to cope with fire regimes, however changes to average temperatures, rainfall patterns, droughts and subsequent reductions in soil moisture are likely to alter fire regimes and make our forests more susceptible to large, destructive bushfire and inhibit their ability to recover post fire. Current research underway examining the response of various forest types to climate change are indicating that the forests will be more susceptible to stressors such as drought, fungal and pathogen attack and bell minor dieback susceptibility.

Disturbances such as development, fires and drought are likely to lead to further degradation or loss of ecological communities. There is likely to be increased vulnerability of natural systems to pest species exacerbated by drought, extreme weather and changes to climate patterns.

Invasive plants and animals continue to exert further pressure on ecological communities and native species and in some cases have health and safety implications for residents (Asian Paper and European Wasp). How a changing climate will impact or magnify the threats from invasive species is unclear, however it will likely make our local ecosystems (terrestrial and marine) more susceptible to impact from invasive species.





## Climate Resilience Benefits

- ✓ Retention of water in catchments, enhance natural system storage
- ✓ Slow release of water to rivers and streams
- ✓ Protection of water quality and flows to estuaries
- ✓ Soil moisture
- ✓ Agriculture production
- ✓ Tourism opportunities
- ✓ Carbon assimilation Forests could be managed to maximise Carbon storage and sequestration potential
- ✓ Forest industry sustainability



## Natural Systems – Catchments and Forests

Performance Measures and Targets	<ul style="list-style-type: none"> <li>• Increase in area of endangered ecological communities</li> <li>• Increase in condition of riparian corridors</li> <li>• Increase in average annual stream flow volumes as measured at Morans Crossing, Kanoona and Angledale</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigation	Adaptation	Lead
SRCMA (LLS)– South East Catchment Action Plan	R1, R2, R3, R11, R19	✓	✓	LLS
Marine Estate Management Plan	R1, R2, R3 R8, R16	✓	✓	MEMA
Draft Regional Water Plan	R1, R11		✓	WATER
Wapengo, Middle Lagoon, Cuttagee and Baragoot Rapid Catchment Assessments	R1, R2	✓	✓	BVSC
South East Weed Management Plan	R2, R13,		✓	BVSC, LLS
OEH Saving Our Species Program	R1, R8		✓	BVSC
South East LLS Local Strategic Plan 2016-2021	R1, R2, R8, R12, R16	✓	✓	BVSC, DPIE, DPI
Regional Land Partnership outcomes - Federal government NLP2 funding program	R1, R2, R3, R13, R17, R19	✓	✓	BVSC, DPIE, DPI, IND
Coastal Forests Management Plan	-	✓	✓	FCORP
Regional corridor strategy (SRCMA)	\$1, \$6		✓	LLS, DPIE
Koala recovery strategy	-		✓	DPIE

Climate Resilience Actions	Risk	Mitigation	Adaptation	Lead	Timeframe	Cost
Initiate a catchment management program targeting private land managers to protect and enhance landscape attributes and biodiversity values critical to climate adaptation and mitigation.	R1, R2, R11,	✓	✓	BVSC, LLS, DPI,	Short	med
Catchment to coast projects focusing on critical catchments of oyster producing lakes.	R1, R19		✓	BVSC, MEMA	Short	Med



Climate Resilience Actions	Risk	Mitigation	Adaptation	Lead	Timeframe	Cost
Support landscape stewardship by individuals and organisations in partnership with local natural resource management organisations.	R2	✓	✓	LLS, BVSC	Med	Med
Strategic wildlife corridor identification and enhancement.	R2		✓	BVSC, LLS DPIE	Med	Low
Upland swamps, hanging swamps and flood plain wetland protection and restoration, focused on the Bega and Towamba River Catchments.	R2, R4, R11		✓	LLS, COM	Med	Med
Identify off stream water storage dam/s – for harvest storage of flood water.	R1, R3, R16, R19	✓	✓	BVSC, LLS, WATNSW	Med	Med
Improve on farm storage potential through regenerative farming practices, riparian restoration and appropriately located storage dams.	R1, R4, R5, R6, R19		✓	LLS	Ongoing	Med
Identify and protect key instream refuge pools for drought periods – designated for access to water, wildlife preservation and recovery. These sites to be focus of catchment rehabilitation efforts and identified in emergency plan.	Ra, R2		✓	BVSC, LLS, DPIE	Short	Med
Establish long term forest community health assessment research and monitoring with Forestry Corp. and NPWS.	-	✓	✓	NPWS, FCORP	Ongoing	Low

Climate Resilience Actions	Risk	Mitigation	Adaptation	Lead	Timeframe	Cost
Review active management requirements of regrowth forests within National Park Estate or State Forests Flora Reserves to improve biodiversity, catchment management and bushfire resilience.	-	✓	✓	NPWS, FCORP	Short	Low
Establish carbon sequestration study of forest and rural landscapes across the Shire to in-form long term management of these areas.	-	✓	✓	FCORP, UNI	Ongoing	Low
Implement South East Weed Management Plan – Priority Actions.	R1, R2, R3, R13	✓	✓	BVSC, LLS, DPI,	Ongoing	Low
Monitoring of target threatened species population and distribution	-		✓	LLS, DPI, BVSC	Med	Low
Increase community capacity to manage and their awareness of invasive species incursions and undertake strategic control programs.	-		✓	LLS, DPI, BVSC	Ongoing	Low
Cooperative cross tenure approach to pest animal management	-	✓	✓	LLS, DPI	Ongoing	Low

# Preparing for Natural Hazards



## Climate Resilience Challenges

Our town layouts have a range of vulnerabilities to physical hazards. Low lying areas of Bermagui, Merimbula and Eden have susceptibility to inundation events and are likely to be impacted by changes in sea levels and tidal regimes into the future. This presents a land use and development planning challenge, with regard to when and what action needs to be taken.

The majority of our beaches suffered significant erosion through a series of storm events during the 1970s, resulting in surf clubs, caravan parks, roads and bridges being damaged or under severe threat. The extensive dune rehabilitation program undertaken by the former NSW Soil Conservation Service and Council saw the dunes accrete large volumes of sand and the recovery of dune vegetation communities. The health of our dune systems was critical in buffering the impact of the 2016 East Coast Low storm event.

There are only a small number of private properties identified in coastal hazard zones for coastal erosion and shoreline recession. The majority of the land currently mapped within these hazard lines is high value public open space, beaches, recreation facilities and caravan parks. Critical infrastructure such as sewage pump stations, Cuttagee bridge and adjoining section of the coast road are currently mapped within high hazard areas and are examples of the adaptation challenges that confront Council and our community.

Our major coastal towns are surrounded by large forested areas and are susceptible to bushfire impact as seen in Tathra in 2018 and in Eden and Tathra in 1952. Development in areas of Merimbula, Tura Beach, Eden, Pambula Beach, Tathra and Bermagui in particular, has increased the length of urban / bushland interface and has greatly increased the vulnerability of populations to the impacts of bushfires. The majority of the Shire is identified as being bushfire prone including the grasslands of the rural valleys. There are key challenges for our community in how to adapt to changed fire regimes and intensities, that may impact our existing settlements, agricultural areas, timber industries and forest eco-systems.

*“The big research challenge is how we’re going to adapt, and build resilient communities, and how will our ecosystems cope with the double combination of fire and drought. [There has been] really no concerted effort to understand the resilience of our human systems to the multiple challenges of drought and fire, and those knowledge gaps could prove costly to communities.” - Professor Ross Bradstock*

Apart from the financial implications for our community in being able to fund this infrastructure network, the extent and linear network make it susceptible to impact from operational breakdowns, natural hazards such as flood, bushfire or storms or climate extremes such as prolonged heatwaves.

The physical location of our sewage infrastructure, popular recreation facilities and critical transport infrastructure like the airport and key connector roads increase the vulnerability to natural hazards impacts. Due to the Shire's topography and functional requirements of the infra-structure, there are limited opportunities for relocations of these assets.

### Climate Resilience Benefits

- ✓ Community safety, health and wellbeing
- ✓ Infrastructure protection
- ✓ Protection of high value natural systems
- ✓ Shorten recovery process
- ✓ Avoid impacts and disruptions to essential service, transport and supply routes
- ✓ Reduction in economic loss and insurance costs





## Preparing for Natural Hazards

Performance Measures and Targets	<ul style="list-style-type: none"> <li>• Increase in beach dune sand volume</li> <li>• Increase in number of dwellings designed to withstand natural disasters</li> <li>• Reduction in annual average insured losses</li> </ul>
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Climate Resilience Projects / Programs	Risk	Mitigation	Adaption	Lead
Bega Valley Shire Bushfire Risk Management Plan	R5, R6, R9, R18		✓	RFS, NPWS, FCORP, BVSC
Bega Valley Shire Hazard Reduction Program	R5, R6, R9,		✓	BVSC
Bega Valley Shire Coastal Processes and Hazards Definition Study	R3, R8, R16, R19		✓	BVSC
Bega Valley Shire Coastal Hazards CMP	R3, R5, R8, R16, R19	✓	✓	BVSC
NSW RFS Planning for Bushfire Protection	R5, R9, R10		✓	RFS
Bega / Brogo River Flood Management Plan	R4, R5, R8, R10, R11		✓	BVSC, DPIE
Eden / Towamba Flood Management Program	R4, R5, R8, R10		✓	BVSC, DPIE
Merimbula Flood Management Program	R1, R4, R8, R10		✓	BVSC, DPIE
Get Ready Council Emergency Preparation Program	R20		✓	BVSC, OEM

Climate Resilience Actions	Risks	Mitigation	Adaptation	Lead	Timeframe	Cost
Prepare strategic asset adaptation plans for high risk Council assets, including the relocation (where practical) of high risk facilities.	R3, R8		✓	BVSC	Med	Med
Develop design guidelines for infrastructure and assets vulnerable to climate impacts.	R8, R9, R10		✓	BVSC	Short	Low
Develop local adaptation plans for communities vulnerable to high climate change risks	R8		✓	BVSC, DPIE, COM	Short	Med

Climate Resilience Actions	Risks	Mitigation	Adaptation	Lead	Timeframe	Cost
Undertake detailed coastal hazard investigations of Horseshoe Bay, Tathra, Merimbula Beach, Pambula Beach, Aslings Beach to provide finer scale mapping than existing in Coastal Hazards Study.	R5, R8		✓	BVSC	Med	Med
Prepare development approval matrix for coastal hazard and flood zones.	R5, R8		✓	BVSC, DPIE	Short	Low
Implement dune protection and management program.	R3, R8		✓	BVSC, DPIE	Short	Low
Undertake flood study and floodplain risk management plan of Bermagui River estuary.	R2, R3, R8, R19		✓	BVSC, DPIE	Medium	High
Implement Bega, Merimbula and Towamba / Eden and Pambula Flood Management Plans.	R1, R5, R8, R19		✓	BVSC	Medium	High
Review climate change hazards at 10 year intervals to incorporate new scientific information	R5, R8		✓	BVSC, DPIE, UNI	Medium	Med
Implement BVS Bushfire Hazard Management Plan.	R5, R6, R9		✓	RFS, NPWS, FCORP, BVSC	Ongoing	Med
Require underground power to new developments in high fire prone areas.	R5, R9		✓	EEGY	Ongoing	High
Support opportunities for cultural burning on publicly managed land.	R6		✓	BVSC, LALC, RFS, DPI, NPWS, FCORP	Ongoing	Low
Plan for and implement hazard reduction and ecological burns on public land, particularly targeting the urban bush interface.	R6		✓	RFS, BVSC, DPI	Ongoing	Med

Climate Resilience Actions	Risks	Mitigation	Adaptation	Lead	Timeframe	Cost
Undertake hazard reduction works on LALC holdings and train landholders in cultural burning practices.	R5, R6		✓	LALC, RFS, NPWS, FCORP	Ongoing	Low
Actively manage asset protection zones.	R6		✓	BVSC, COM, NPWS, DPI, RCORP	Medium	Low
Expand bushfire preparedness community education program across Shire.	R4, R5, R6	✓	✓	RFS	Short	Low
Undertake specific studies on forest fire behaviour risk at key sites in Bermagui, Tura Beach, Eden and Wonboyn and selected grassland sites.	R5, R6		✓	RFS, NPWS, FCORP, BVSC	Ongoing	Low



# Liveable and Connected Places



## Climate Resilience Challenges

The Shire's major land uses (National Parks, State Forest and Agriculture) are acutely vulnerable to changing rainfall patterns, drought and the risk of bushfire. These major land uses are the drivers of our local dairy, beef, tourism and timber industries and enhancing our understanding of how climate change will impact on these land-uses is critical for the sustainability of these industries and the future strategic land use planning of the Shire.

The distance between our towns and villages and sparse distribution of our population presents a range of resilience challenges. Residential subdivisions, particularly through the 1980s have relied on vehicle transport for most journeys with limited access to everyday services within walking distance.

The popularity of rural residential living has resulted in over 30% of the Shire's population being located outside of towns and villages. These residents are generally self-reliant with regard to water supply and grid connected for power supply, which has increased the length of the electricity network.

The Shire's water supply is heavily reliant on two major bore fields (Bega River / Towamba Rivers), the Brogo Dam, Cochrane Dam (Bemboka River) and Tantawangalo Weirs. These sources are all some distance from their most distant potable water recipient. The reticulation of the Shire's water supply relies on an extensive network of water mains, pumps stations, holding dams and reservoirs.

A key function underpinning the sustainability of our community and reduction of our green-house emissions is the effective management of our waste stream. Bega Valley Shire has transitioned to a more efficient, centralised waste collection and disposal operation, with a strong focus on resource recovery and diversion of recyclable products. The lack of local recycled materials processing facility means the majority of recycled material needs to be transported out of the Shire. Not only is this a lost economic opportunity, it further increases our greenhouse emissions, as these resources are transported to other regional centres.

Housing trends have seen the average house increase in size, increasing energy requirements and the hard surface coverage of the allotment and reducing the area available for garden plantings, vegetable gardens and canopy tree plantings. These factors have the potential to exacerbate increased average temperatures or prolonged heatwave conditions.

The Bega Valley Shire has had a traditionally strong sporting culture, thanks partly to our access to extensive sporting facilities. The playability of these sports fields is based on good grass cover, requiring irrigation, which is generally drawn from reticulated water supply systems. Potential increases in average temperatures, increased transpiration rates and rainfall variability will put pressure on Council to be able to maintain these facilities and other non-irrigated urban parklands.



### Climate Resilience Benefits

- ✓ Sustainable development and growth
- ✓ Efficient land use
- ✓ Economic sustainability
- ✓ Improved neighbourhood amenity and access to open space networks
- ✓ Pedestrian friendly town layouts
- ✓ Improved health through pedestrian and cycle opportunities
- ✓ Local access to essential services
- ✓ Reduction in vehicle reliance
- ✓ Reduced consumption
- ✓ Recycling value adding
- ✓ Reduced need for landfill sites
- ✓ Produce energy from waste

## Liveable and Connected Places

Performance Measures and Targets	<ul style="list-style-type: none"> <li>• Increase in population living within 800 metres of the centres of our major towns</li> <li>• Increase in use of active transport</li> <li>• Reduction in waste to landfill</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead
Bega Valley Shire Council CLEP (2013)	R1, R4, R5, R7, R8		✓	BVSC, DPIE
BVSC Local Strategic Planning State-ments	R1, R4-8 R11, R16, R19, R20	✓	✓	BVSC
Bega Valley CBD Masterplans	R7		✓	BVSC
Urban Ecosystem Restoration Pro-gram	R1, R2, R3, R6, R16	✓	✓	BVSC
BVSC Bike Plan	R5, R7	✓	✓	BVSC
South East and Tablelands Regional Plan	R1, R4-9, R11, R15, R19	✓	✓	DPIE, BVSC
BVSC Residential Strategy	R5, R20		✓	BVSC
BVSC Rural Residential Strategy	R4, R5, R7, R10,	✓	✓	BVSC, DPIE
BVSC Natural Assets Management Strategy	R1, R2, R3, R6, R16, R19		✓	BVSC
Waste Management and Resource Recovery Strategy (2018-2028) 'Recycling the Future'	R5, R17	✓	✓	BVSC

Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Apply smart growth and climate ready principles to new development.	R5, R18	✓	✓	BVSC	Ongoing	Nil
Review major towns for opportunity for more compact, higher density living opportunities, close to town centres.	R5, R6	✓	✓	BVSC	Short	Low
Place based planning for key town centres with a focus on adapting them for a warming climate.	R5	✓	✓	BVSC	Short	Low

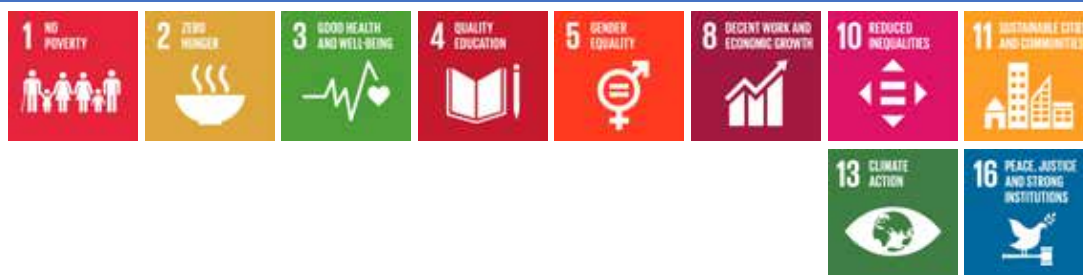
Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Implement BVSC Bike Plan with a key focus on improving pedestrian and cycling connectivity between residential areas, town centres, schools and open space networks.	R7	✓	✓	BVSC	Ongoing	Med
Implement street tree, open space and parkland tree planting program across all towns and villages to mitigate heat stress.		✓	✓	BVSC	Short	Low
Incorporate native plantings into all infrastructure development, minimise mowing and maintenance.	R1, R2	✓	✓	BVSC	Ongoing	Low
Expand urban ecosystem restoration program to villages and connectivity to adjoining natural areas.	R1, R2, R6	✓	✓	BVSC, DPIE	Short	Low
Incorporate new technology into new developments including micro gridding, energy efficiency and virtual gridding.	R18	✓	✓	EE, BVSC, COM	Medium	Med
Facilitate access of multi-unit housing residents to renewable energy generation opportunities.	R18	✓	✓	BVSC	Medium	Nil
Ensure rural residential development adjoins existing development, does not increase infrastructure network, hazard exposure or car reliance.	R5, R7, R9, R10	✓	✓	BVSC	Ongoing	Nil
Allow for more flexible and sustainable housing options.		✓	✓	BVSC	Short	Nil
Develop options for CBD parklands in Merimbula, Eden and Pambula.		✓	✓	BVSC	Short	Low

Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Identification of strategic land acquisition / dedication priorities for key public access, facility expansion or critical environmental assets			✓	BVSC	Short	Low
Maximise reuse of water, energy and materials in Council assets.		✓	✓	RFS	Ongoing	High
Education programs and interactive workshops around reuse and recycling opportunities.	R17, R18	✓	✓	BVSC	Ongoing	Low
Communications infrastructure improvements, review and investigate capacity of the system, communications management.	R9		✓	BVSC, EE, NBN, TELS-TRA	Short	High





# Safe, Healthy and Inclusive Community



## Climate Resilience Challenges

The Shire's population is ageing, which will increase the pressures on our health services, aged care / housing sector, disability services and community transport providers.

A warming climate and predicted increase in the number of hot days and length of heatwaves, is the most significant challenge to the physical health of our residents.

The mental health impacts on residents directly affected by climate extremes (e.g. primary producers) and people who are experiencing a heightened level of anxiety based on concerns around the impacts of climate change are an emerging public health concern.

The Shire has an extremely tight rental market, with many residents having difficulty finding rental properties in close proximity to their place of employment. Transitioning existing housing stock to more energy efficient and climate ready is a major challenge for owners of private property, government and community housing providers.

The rapid increase in land and housing prices within the Shire and in particular our highly desirable coastal locations has had major implications for local residents looking to enter the housing market, who are increasingly competing with people moving to the Shire from Sydney, Melbourne and Canberra. This has had the effect of our villages being seen as increasingly important suppliers of more affordable land and housing options, along with some of our inland rural residential areas.

Whilst there have been improvements in local educational opportunities and access to tertiary education and training opportunities via online providers, they are still limited and continue to contribute to the loss of younger age cohorts from our region. The Shire has an unemployment rate of 6.7% in comparison to the NSW Regional rate of 5.9%, which is a further key driver of the loss of younger people from our Shire.

A key measure of resilience is the strength of an areas social and community networks. These networks are vital in the retention of local knowledge and skills, integration of new residents and providing support during challenging times such as natural disasters or personal difficulties. A critical factor in the success of social and community networks is the contribution of volunteers to a range of community and sporting groups, emergency services and service providers. Our volunteers are a key factor in the resilience of our individual towns and villages and for the Shire as a whole as demonstrated in the Tathra and Bemboka bushfires in 2018.

## Climate Resilience Benefits

- ✓ Reduction in heat induced mortality and illness
- ✓ Reduced mental health pressures
- ✓ Increased volunteerism
- ✓ Better connected, integrated community
- ✓ Access to climate ready accommodation



## Safe, Healthy and Inclusive Community

Performance Measures and Targets	<ul style="list-style-type: none"> <li>Reduction in heat related morbidity and mortality</li> <li>Increase in volunteer hours</li> <li>Improvement in average SEIFA index</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead
Drought Communities Program	R4, R11, R12, R14		✓	DPI, LLS, BVSC, IND
BVSC Residential Strategy	R5,		✓	BVSC
Cooler places in a Warmer Climate Project	R18, R20	✓	✓	BVSC
Statewide Heatwave Sub Plan	R20	✓	✓	OEM, SES, HEALTH, BVSC
NSW Climate Change Fund – renewable energy and efficiency programs	R18	✓	✓	DPIE
Rural Advisory Mental Adversity Program	-		✓	HEALTH, LLS, IND, COM

Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Support for climate ready affordable and community housing.	R5	✓	✓	HOUSING, BVSC, DPIE	Medium	Nil
Community wide targeted extreme heat information campaign.	R20	✓	✓	BVSC, OEM, HEALTH	Ongoing	Low
Review Senior Housing Developments extreme weather preparedness and procedures.	R20		✓	IND, HEALTH, OEM	Medium	Low
Ensure SRH has full capacity to deal with heat waves.	R20	✓	✓	HEALTH	Short	Low
Ongoing support for mental health awareness and access to support services for at risk sectors.	-		✓	HEALTH	Ongoing	Med
Ensure renewable energy development programs (retrofits, solar PV) are based on social equity principles and provide access opportunities to all members of the community.	R18	✓	✓	DPIE	Ongoing	Nil

Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Council facilitation of a climate resilience network to drive implementation of this Strategy.	R18, R21	✓	✓	BVSC	Ongoing	Nil
Support community leaders and community resilience coordinators.	R21	✓	✓	BVSC	Short	Low
Promote, encourage and support diversity to strengthen our communities expertise, knowledge resilience.	R13, R14, R17, R18		✓	BVSC, FACS	Ongoing	Nil
Community Hall's promoted as the hub of community driven outcomes, resilience and emergency preparations and fire safety drills.	R5, R21	✓	✓	BVSC	Short	Low
Increase rates of volunteerism across all sectors, through administration, risk and technical support.	R21	✓	✓	BVSC, LLS, RFS, SES	Ongoing	Nil
Enhance resilience and partnerships with local Aboriginal community.	-	✓	✓	BVSC, LALC	Short	Low





# Diverse and Thriving Economy – Dairy and Agriculture



## Climate Resilience Challenges

No local industry is as exposed to the potential impacts of climatic variations as the dairy industry, with its reliance on water access and irrigation. Eighty percent of milk supplied to the Bega Cheese plant comes from irrigated pasture within the Bega Valley. The over allocation of water from Brogo Dam, the prioritising of Cochrane Dam for electricity production and the unregulated status of the Bega River are key challenges for the parts of the agricultural sector with reliance on irrigation.

The ability to produce fodder on farm is also impacted by air temperature, rainfall and soil moisture. In recent years local farmers have looked to strengthen their resilience by increasing their capacity to store fodder on farm during good seasons to reduce the need to transport grain and hay from other parts of NSW and Victoria. Climate change modelling indicates the inland areas of NSW and Victoria are predicted to be impacted by reductions in rainfall and temperature increases, which may see external animal fodder availability come under further pressure in the future.

Our existing beef producers and emerging agricultural industries such as small lot agriculture and specialist horticulture also have a high sensitivity and exposure to changes in climatic conditions and subsequent physical impacts. These industries also rely on access to external markets and are subject to competition from other regions.



## Climate Resilience Benefits

- ✓ Sustainability and profitability of all agricultural sectors
- ✓ Local economy multiplier effect of dairy industry
- ✓ Health and well being of our farmers
- ✓ Animal health
- ✓ Local food and fibre production
- ✓ Agricultural diversity and new economic opportunities



## Diverse and Thriving Economy – Dairy and Agriculture

Performance Measures and Targets	<ul style="list-style-type: none"> <li>Increase in area of existing rural land being actively farmed for food and fibre production</li> <li>Increase in catchment storage capacity across the Bega, Brogo and Towamba River Basins</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead
Southern Livestock Adaptation 2030 initiative	R13, R14	✓	✓	DPI, LLS, BVSC
Bega Cheese BEMS Farm Sustainability Program	R2, R11, R12, R13	✓	✓	IND, BVSC
Bega / Brogo and Towamba Water Sharing Plans	R11, R13	✓	✓	WATER, BVSC
NSW Regional Water Management Strategy	R11, R13	✓	✓	WATER, BVSC
BVSC CLEP (2013)	R4, R5		✓	BVSC
Dairy Australia Climate Toolkit	R11-13, R18		✓	IND, COM

Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Investigate raising of Brogo Dam spillway to increase dam storage.	R11		✓	WATER, IND BVSC	Short	Med
Support ongoing research by Dairy NSW and MLA impact on cattle health and production.	R13, R14	✓	✓	DPI, IND, COM	Ongoing	Nil
Protect farmland along river valleys and large intact holdings.	R4, R11		✓	BVSC, DPI, COM	Short	Nil
Establish farm shelter belts, shade planting and natural systems storage projects .	R13	✓	✓	COM, DPI, LLS, IND	Short	Med
Support the increase of local fodder production and storage capacity.	R13, R14	✓	✓	DPI, LLS, IND	Short	Low
Develop locally based research trials into high quality feed source development.	R13, R14, R17	✓	✓	DPI, LLS, IND	Medium	Low

Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Implement soil carbon enhancement programs across all agricultural and horticultural sectors.	R13, R14	✓	✓	LLS	Short	Low
Extend beneficial reuse schemes to ensure all farm, commercial and residential wastewater reuse options for agriculture.	R11, R12, R13		✓	BVSC, LLS	Medium	High
Support new small acreage farmers moving into the valley, with locally relevant climate and agronomy data.	R17	✓	✓	DPI, LLS, IND	Ongoing	Nil
Retain the Bega saleyards as key asset in local food production and reduction in transport emissions.	R13, R14, R17	✓	✓	BVSC	Ongoing	Low
Ensure existing rural zonings adequately identify high value agricultural land and provide sufficient flexibility for new agricultural industries.	R4		✓	BVSC	Short	Nil
Provide funding / support for Local Farmers network.	R4, R17	✓	✓	DPI, LLS, IND	Ongoing	Low
Undertake specialised energy audits and efficiency programs for farms.	R13, R18	✓	✓	DPI, LLS, DPIE	Short	Low
Undertake education and capacity building in water use efficiency, irrigation scheduling and effluent re-use.	R12	✓	✓	DPI, LLS, IND	Short	Low
Ongoing improved grazing management practices based on understanding of impacts of climate change on local production	R13, R14	✓	✓	DPI, LLS, IND	Ongoing	Low



Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Increase awareness and capacity of landowners to improve soil health, leading to greater water infiltration, higher fertility (leading to greater drought resilience and better drought recovery in pastures as well as greater carbon sequestration).	R13, R14	✓	✓	DPI, LLS, IND	Ongoing	Low
Undertake research into improved pasture management, including deeper rooted perennials and inclusion of species more resilient to climate change, while also providing enhance animal nutrition.	R13, R14	✓	✓	DPI, LLS, IND	Short	Med



## Diverse and Thriving Economy – Tourism



### Climate Resilience Challenges

The tourism industry still retains a degree of seasonality, increasing the sustainability challenges for tourism based operators and other businesses that rely on tourism income. Further, the tourism season mirrors our highest risk bushfire period.

The various components of our tourism industry are heavily reliant on the quality of the natural environment and the productivity of the various marine, estuarine and forest ecosystems. Potential impacts on our environment have a direct relationship to the tourist and visitor economies, including estuarine health, changes in fish stocks, beach recession and loss of tourism focused recreational assets.

The majority of our tourism is focused in our coastal zone where the most significant impacts of climate change are predicted to occur. Modelled coastal inundation in key tourist locations is a major land use planning challenge for Council and the tourism sector.

### Climate Resilience Benefits

- ✓ Sustainability of industry
- ✓ Local economic multiplier
- ✓ Emergency preparedness
- ✓ Competitive advantage

## Diverse and Thriving Economy – Tourism

Performance Measures and Targets	<ul style="list-style-type: none"> <li>Increase in the value of visitor economy</li> </ul>
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Climate Resilience Projects	Risks	Mitigation	Adaption	Lead
Tathra – Sapphire Coast Tourism Resilience Project	R15,16		✓	IND, BVSC
Tourism Emergency Management Fact Sheet	R17		✓	OEM, RFS
NRMA Electrical Vehicle Charging Project	R5, R7, R18	✓	✓	IND, BVSC

Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Specific impacts of climate change on tourism incorporated into local adaptation plans	R15, R16		✓	BVSC	Short	Low
Support enhanced adaptive capacity of the tourism sector to climate change and disaster risks.	R15, R16		✓	DEST NSW, IND, BVSC	Ongoing	Low
Diversification of industry into non nature based attractions.	R16	✓	✓	IND, BVSC	Medium	Low
Develop guidelines for future climate ready tourism infrastructure.	R15, R16	✓	✓	IND, BVSC	Medium	Low
Adopt and promote best practice guides to emissions management for use by destinations, business event organisers and enterprises.	R16	✓		DPIE	Short	Low
Undertake emergency planning and readiness programs for local tourism accommodation providers.	R5, R16,		✓	OEM, INC	Short	Low
Improve and promote water and energy efficiency measures to tourist and visitors.	R5, R8	✓	✓	IND	Ongoing	Low
Promotion of Shire as a climate resilient destination.	R15, R16		✓	BVSC, IND	Medium	Low
Identify audiences for tourism climate awareness programmes including tourist operators, communities, etc	R15, R16	✓	✓	BVSC, IND	Medium	Low

# Diverse and Thriving Economy – Logistics and Transport



## Climate Resilience Challenges

The reliance on external food and manufactured goods production requires a sustainable and efficient transports and logistics system, which is currently a challenge with available technology. The freight transport and logistics system is reliant on semi-trailers and a supporting network of smaller trucks to meet the point to point nature of our supply and distribution system.

There has been significant improvements in the efficiency of diesel engines over recent decades, which has the net result of lowering fuel consumption and emissions. Despite advancements in electric engine technologies and penetration of this technology to the light truck market, there has not yet been successful development of heavy truck electric engines with the requisite power, capacity or reliability required to service current industry needs.

The use of large trucks to reduce emissions from the freight industry, by reducing the number of trucks is required as part of the logistics supply chain. However the use of large trucks is inhibited by current access restrictions north of Bega on the Princes Hwy and to the west by Brown Mountain.

Provision of long-term air services is challenging with the location and height of the Merimbula Airport runway, which is subject to future tidal inundation.

## Climate Resilience Benefits

- ✓ Access to markets for local goods
- ✓ Import of externally grown food and manufactured goods
- ✓ Local employment
- ✓ Sustainability of airport infrastructure



## Diverse and Thriving Economy – Logistics and Transport

Performance Measures and Target	<ul style="list-style-type: none"> <li>Increase in electric vehicle registration</li> <li>Reduction in per pallet freight relative cost</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead
NSW Regional and Infrastructure Plan (Future Transport)	R5, R7, R17, R18	✓	✓	RMS
BVSC Bike Plan	R5, R7	✓	✓	BVSC
RMS Highway Corridor Strategy	R5, R17, R18		✓	BVSC
Merimbula Airport Master Plan	-		✓	BVSC
NRMA Electrical Vehicle Charging Station	R7, R18	✓	✓	RFS

Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Partner with local freight companies, trucking companies and Universities in undertaking research and trials on fuel efficiency for large trucking fleet.	R17, R18	✓	✓	IND, UNI, BVSC	Short	Med
Transition vehicles across the Shire to electric, hydrogen and biofuel fleet	R17, R18	✓	✓	IND, COM, BVSC	Short	Med
Lobby for State Government take over ownership of Imlay Rd and undertake upgrades as medium term solution for east – west freight access.	R17		✓	BVSC, IND	Short	Low
Advocate for improved B-Double Access into the Shire to reduce individual truck movements, increase fleet efficiency and access to larger freight movements.	R17, R18	✓	✓	BVSC, IND	Short	Low
Support local public transport, within and between towns and villages.	R5, R7, R20	✓	✓	TF NSW	Medium	Low
Implement BVSC Bike Plan, including shared pathway Bega – Tathra, Tura – Merimbula, Cuttagee to Wallaga, Bega – Tarraganda, Bega to South Bega	R5, R7	✓	✓	BVSC	Ongoing	Med to High

Climate Resilience Actions	Risks	Mitigatin	Adaption	Lead	Timeframe	Cost
Ensure active transport is key priority in town centre CBD planning and design of new subdivisions.	R7	✓		BVSC	Ongoing	Nil
Identify key transport links in Bermagui, Tathra and Merimbula areas subject to future inundation and develop long-term strategies for inclusion in BVSC Transport Asset Plan.			✓	BVSC	Medium	Nil
Reduce number of single person trips.	R5, R7	✓	✓	TF NSW, COM	Short	Nil
Support of community transport.	R5, R7, R20		✓	TF NSW	Ongoing	Low



# Diverse and Thriving Economy – Aquaculture, Fishing & Forestry



## Climate Resilience Challenges

Bega Valley Shire's oyster industry is concentrated in six estuaries between Bermagui and Wonboyn and has a unique dependence on the ecological health of our estuaries and specifically the water physio-chemical parameters and levels of organic and chemical pollutants. Predicted changes in rainfall intensities and distribution, increasing average temperatures and heatwaves, in combination, will exert significant pressures on oyster aquaculture.

The recent move to floating infrastructure, rather than traditional stick and rack methods, will help the industry cope with changes in sea levels. However, sea level rise will pose a long term threat to shore-based infrastructure. Impacts on oyster growth rates and production levels from any potential changes in estuarine ecology and water quality factors is a further key threat to the aquaculture industry, including the mussel leases in Twofold Bay. Pathogens and introduced species and diseases that arrive via international shipping are a key threat to our marine ecology.

Both the professional and recreational fishing industries are reliant on the health of our estuaries and the offshore marine environment. Current regulations governing the Estuary General Fishery have resulted in professional effort being focused in a small number of estuaries, which is a further stressor on target species abundance.

The Eden and Bermagui fishing fleets are reliant on fishing grounds across the South East Australian marine region and are particularly susceptible to any changes in species distribution and abundance. Any changes to the sustainability of the industry will have direct impacts on the Eden and Bermagui economies. Both the estuary and marine based fishing industries provide our Shire with locally produced food sources, that would otherwise be sourced from areas beyond the Shire.

The State Forest Estate encompasses 1300km<sup>2</sup> and is focused in the southern part of the Shire. The majority of this area is dedicated timber production of pulpwood, hardwood logs and softwood plantations in the Towamba Valley. The timber industry is a significant employer within the Eden area in particular, with direct employment forest management, harvesting, manufacturing and export. Like the dairy and tourism industries there are important multiplier impacts of these jobs in the local economy.

The likely combined stressors of changing rainfall, increased temperatures and reduced soil moistures, and the increased incidence of disease, will outweigh any modelled growth benefits from increased atmospheric carbon. Further, forests under stress are likely to be more vulnerable to impact from disease and pathogens.

## Climate Resilience Benefits

- ✓ Industry sustainability
- ✓ Estuarine health
- ✓ Local economy
- ✓ Local food production
- ✓ High value timber production
- ✓ Carbon sequestration





## Diverse and Thriving Economy – Aquaculture, Fishing & Forestry

Performance Measures and Target	<ul style="list-style-type: none"> <li>• Increase in aquaculture production</li> <li>• Increase in value of timber production</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead
Bega Valley Shire Bushfire Risk Management Plan	R5, R6		✓	RFS, NPWS, FCORP, BVSC
Environmental Mgmt. Systems (Oyster Industry)	R1, R2, R10, R19,		✓	BVSC, IND
Marine Estate Management Plan	R1, R2, R8, R19		✓	MEMA, BVSC, IND
Coastal Forests Management Plan	-	✓	✓	FCORP
BVSC Love Our Lakes Program	R1, R2, R10, R16/9		✓	BVSC, IND

Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Examine options for co-funded water quality monitoring programs focusing on estuarine health and key climate change indicators.	R1, R16, R19		✓	BVSC, IND	Short	Med
Establish baseline data on water temp. and pH, to complement existing MER data collected by Council and DPIE.	R1, R16, R19		✓	BVSC, LLS, DPIE	Short	Low
Allow landward migration of wetlands	R1			BVSC, DPI, COM	Short	Med
Protect estuary foreshores and sensitive estuarine catchments.	R1, R2, R5, R19		✓	BVSC, DPIE	Ongoing	Low
Partner with oyster industry in the development of “Onshore Infrastructure Expansion Strategy” to identify areas to relocate vulnerable facilities and expand storage and sorting facilities.	R19		✓	IND, BVSC, DPIE	Medium	Med

Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Develop high value timber products and other post-harvest locally based value adding and manufacturing.	R17	✓	✓	FCORP, IND	Long term	Med
Work with industry to examine reforestation potential of low value agricultural land for silviculture and carbon offsetting sites.	R4	✓		FCORP, IND, COM	Medium	Low
Ensure regrowth forest and plantation assets are identified as key assets for protection in BVS Bushfire Risk Management Plan.	-	✓	✓	FCORP, RFS, IND	Short	Nil
Examine options for irrigating waste water on tree plantations and the harvest of trees for chip or biochar products.	-	✓		FCORP, IND	Medium	Low
Instigate baseline research into species diversity and abundance of key commercial aquatic species including the abalone fisheries.	R1		✓	MEMA, DPI, IND	Short	Low
Identify new marine and estuarine industries including seaweed farming and carbon sequestration	R1	✓	✓	UNI, BVSC, DPI, UNI	Short	Low
Examine sustainability of estuary fishery in ICOLLs experiencing prolonged closures.	R1		✓	DPI, MEMA	Medium	Low

# Energy Security



## Climate Resilience Challenges

The Shire is reliant on external sources for the vast majority of its energy supply and generation. While the Bega Valley Shire has a relatively high uptake of solar arrays by private residents and business, the majority of our electricity needs are generated elsewhere. The import of this electricity into the Shire is reliant on the major west – east high voltage line running from the Monaro, down Brown Mountain into the Bega Valley.

This single point of connection to the external electricity grid, leaves the Shire highly exposed to climatic driven physical impacts to the major distribution infrastructure or operational breakdowns within the electricity network. Beyond the transmission network, we are experiencing challenges with generation capacity restrictions and high demand blackouts.

The majority of energy production in NSW is from fossil fuel fire power stations, with the electricity production sector being the largest emitter of greenhouse gasses in Australia. If our Shire is to achieve a future net zero emission target, we will be reliant on continued energy efficiency measures, increased local renewable generation developments, access to external renewable energy sources and large-scale carbon offsetting projects. A further impact of our reliance on external energy sources is the loss of dollars from our local economy.

All petrol, diesel and gas supplies are brought into the Shire via road transport following the decommissioning of distribution and storage facilities at the port of Eden. This reliance on external fuel supplies is predicted to continue and is a challenge for the future. Private and industry fuel use and subsequent greenhouse gas emission is a reality of life in a rural area and our distance from larger centres and markets.

As with electricity consumption, a mix of improved vehicle efficiencies, technological advancement with electric and hydrogen cell engines, charging station networks and carbon offsetting will be required if we are to achieve carbon neutrality.

## Climate Resilience Benefits

- ✓ Reliable energy supply
- ✓ Energy price stabilisation
- ✓ Infrastructure resilience
- ✓ Retention of energy funds in local economy
- ✓ Dispatchable local energy supply
- ✓ New industry development





## Energy Security

Performance Measures and Target	<ul style="list-style-type: none"> <li>Reduction in cost of household energy</li> <li>Net zero emissions (with interim target of 100% renewable electricity by 2030)</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigation	Adaption	Lead
BVSC Council Clean Energy Plan (2019)	R18	✓	✓	BVSC

Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Develop pathway to net zero greenhouse gas emissions by 2040.	R18	✓	✓	BVSC	Short	Med
Implement BVSC Clean Energy Plan	R18	✓		BVSC	Ongoing	Med
Develop a program of mitigation activities for implementation across Shire, including the identification of primary sequestration and offsetting options.	-	✓		BVSC, COM, IND, DPIE	Medium	Med
Remove barriers to micro grid and virtual grid opportunities.	R18	✓	✓	BVSC, EE, IND	Medium	Low
Develop best practice community renewable energy projects for roll out across the Shire.	R18	✓	✓	BVSC, COM, DPIE, IND	Short	Low
Develop new re-newable energy opportunities within the Shire including pumped hydro, wave power and pyrolysis, as they become financially viable	R18	✓		ND, COM	Ongoing	High
Support new and emerging technologies and research opportunities within the Shire, as they become feasible	R18	✓		BVSC, EE, COM, UNI, IND	Ongoing	Low

Climate Resilience Actions	Risks	Mitigation	Adaption	Lead	Timeframe	Cost
Promote energy efficiency as part of new developments and pursue retro-fitting of older housing and commercial stock.	R18	✓	✓	EE, BVSC, COM, IND	Short	Low
Undertake feasibility study on the development of hydrogen export plant at Twofold Bay.	R18	✓	✓	DPI	Short	Med
Incentives for development and relocation of light industries focusing on transition opportunities.	R17		✓	DPIE, BVSC	Medium	Med
Establish Electric vehicle charging network throughout Shire and require new large commercial development to install as development consent condition.	R7, R18	✓	✓	BVSC, RMS, IND	Medium	High
Support local networks and organisations to advance innovative renewable energy projects with maximum public benefit.	R18	✓	✓	BVSC, COM	Ongoing	Nil
Develop projects to support low socio-economic sectors of our community to access renewable energy.	R18	✓		BVSC, IND, COM	Medium	Med
Adopt renewable energy technologies.	R18	✓	✓	COM, IND	Ongoing	Low

# Food Security



## Climate Resilience Challenges

As with our energy and fuel imports, the Shire is heavily dependent on external suppliers for majority of manufactured goods and food. Despite the Shire producing high quality meat, vegetable, seafood and dairy products, the scale of production does not meet the requirements of our local populations.

The entire Bega Valley Shire population is currently reliant on only six major and four minor supermarket outlets for the vast majority of our food supply, fresh and manufactured. Whilst community markets and home grown food provide a source of locally produced food, the vast majority of our food is produced elsewhere. This external food production is exposed to climatic conditions in other regions across Australia and any shock to the logistics and transport network will affect our food supply chain.

Barriers to the expansion of the local food production industry, include water access, ability to sell produce at significant scale through local supermarkets, distance from markets and competition from imported products. Pathways to local food security will be heavily impacted by future climate variability, and in particular rainfall variability and temperature increases.

## Climate Resilience Benefits

- ✓ Locally produced food
- ✓ Reduced greenhouse gas emissions
- ✓ Niche product developments opportunities
- ✓ Local employment
- ✓ Food Providence
- ✓ Reduction in “food miles” and carbon footprint
- ✓ Increased community knowledge
- ✓ Permaculture and regenerative farming

## Food Security

Performance Measures and Target	<ul style="list-style-type: none"> <li>• Increase in locally produced food</li> <li>• Increase in area of land zoned for small lot agriculture</li> </ul>
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Climate Resilience Projects / Programs	Risks	Mitigatin	Adaption	Lead
SCPA South East Food Plan	R4, R17	✓	✓	COM, IND
Bega Valley CLEP (2013)	R4,	✓	✓	BVSC
SCPA Climate Smart Farming Project	R4, R17	✓		COM
DPI Important Agricultural Land Identification Project	R17	✓	✓	DPI

Climate Resilience Actions	Risks	Mitigatin	Adaption	Lead	Timeframe	Cost
Ensure high priority productive land is protected from urban or commercial development.	R4, R17		✓	BVSC	Short	Nil
Support small lot agriculture.	R4, R17	✓	✓	BVSC, DPI, LLS	Short	Nil
Apply regenerative farming practices to in crease the productive capacity of rural land for food production.	R17,	✓	✓	LLS, IND, COM	Ongoing	Low
Develop incentives based schemes to attract new horticultural or agricultural enterprises, particularly to under-utilised rural land.	R17,		✓	DPI	Medium	Med
Promote Artisan and Gourmet food setups and pop-ups through marketing and business setup advice.	R16, R17	✓		BVSC, DPIE	Short	Low
Support community based food production	R17	✓	✓	BVSC, IND, COM	Short	Nil
Capitalise on the benefits of renewable energy technologies and their integration into farming enterprises.	R18	✓	✓	LLS, DPI, IND	Ongoing	Low
Support high value small farm enterprise opportunities unique to the Bega Valley's climate and soils.	R17	✓		LLS, BVSC	Medium	Low



Climate Resilience Actions	Risks	Mitigatin	Adaption	Lead	Timeframe	Cost
Develop food trail maps and tours.	R15, R16		✓	IND, BVSC, DNSW	Medium	Low
Increase knowledge and skills of local food producers in a diversity of food production opportunities in the Bega Valley.	R17	✓	✓	COM, LLS	Short	Low
Encourage water security with home water tanks, appropriate landscaping, and sensitive urban water design.	-	✓	✓	BVSC	Short	Low
Support local production of small animal meat products.	R17	✓	✓	COM, IND	Medium	Low
Develop distribution and logistics systems to export locally produced food.	R17	✓	✓	IND, COM, BVSC	Medium	Low
Encourage new technologies for sustainable food production.	R17	✓		BVSC	Ongoing	Low
Support sustainable local food education and production initiatives.	R17	✓		LLS, DPI, BVSC	Medium	Low



# Appendix 1 - Local Resilience Case Studies

## Case study in resilience and recovery

### Tathra – Reedy Swamp – Vimy Ridge

The Tathra, Reedy Swamp and Vimy Ridge communities were devastated by a out of season wildfire in March 2018. The fire saw the loss of 65 homes and units and 1000 ha's of the surrounding landscape blackened.

The fire created a range of physical, financial and emotional impacts on the residents of these communities and resulted in many residents having to find accommodation in other local towns. There was a large Council, State Agency and Charity organisation response to the disaster. Even more critical in the initial response and ongoing recovery was the Tathra community and the various community groups that form the backbone of this tightknit community.

The Tathra Lions Club, Surf Club, Tathra Sunshine Boardriders Club, Local Churches, Tathra School community, Tathra Bowling Club and Country Clubs are just some of the local community groups who all swung into action to provide physical, financial, emotional and social support to all those impacted by the community.

The strength of the existing Tathra based community groups and well developed networks have undoubtedly hastened the recovery of Tathra, Reedy Swamp and Vimy Ridge, including the restoration of the much valued natural environment and local outdoor recreational facilities that were damaged during the fires.





## Case study in industry resilience

### The dairy industry

No other local industry is as exposed to the challenges of climatic variations than the dairy industry. From its establishment in the late 1800's to the present day the dairy industry has battled intense droughts, water shortages and devastating floods.

In more recent years industry restructures, global market forces, landuse pressures and supermarket milk price wars are examples of non-climatic shocks and pressures that have weighed heavily on our local farmers and the many hundreds of local residents who rely on this industry for employment.

Despite the loss of some local farmers from the industry, competition from other regions and continued climatic challenges, the remaining farmers have exhibited resilience through innovation, adaptation and passion for the industry and their land. Embracing technology, changing milking and feeding practices, pursuing improvements in fodder quality and achieving irrigation efficiency are just some ways the dairy industry is demonstrating its ongoing resilience.

The passion of our local farmers for their industry, their animals and their land has seen them challenge political and bureaucratic barriers, remain competitive in an aggressive global market and pursue the ongoing environmental on farm enhancement.



## Case study in community resilience - Eden

The Eden community has had a traditional reliance on natural resource based industries such as the fishing and forestry and their respective onshore value adding sectors e.g. fish processing, former tuna cannery, sawmill and pulp mill. These industries also had an important local economic multiplier impacts with numerous local service businesses reliant on these primary industries.

This reliance on natural resource based industries has seen Eden susceptible to shocks and stressors, such as the closure of the Tuna cannery in 1999 with the loss of over 200 jobs and ongoing contractions of the timber industry.

Having a reliance on natural resources also exposes industries to climate change driven environmental or species changes and the impact of more severe natural hazards.

Despite all the tremendous challenges that have confronted the Eden community over the last 20 years, they have endured and continued the fight for the survival and success of their town. Rather than allow the past economic factors to define the town's future, the Eden community has worked tirelessly to look for other opportunities that provide a sustainable future for the town and its residents.

Eden is blessed with perhaps the most spectacularly beautiful and dramatic coastline on the south coast, focused around the magnificent natural asset that is Twofold Bay. Rather than waiting for external help, the Eden community had recognised the opportunity that its amazing natural setting and Twofold Bay presents and have worked tirelessly to develop new industries based on these assets.



The recent completion of the Snug Cove wharf extension has cemented the cruise industry as a prominent part of Eden's future. Early adaptors of change such as the Eden Smokehouse, Southland Fish Supplies and Eden Mussels have helped arrest the economic decline, along with the expanding nature based tourism activities such as whale watching, marine discovery centre and popular camping and multi-day walking opportunities.

The Eden community has demonstrated key characteristics of a resilient system: flexibility, adaptive, responsive to change and resourcefulness. The Eden example also highlights the importance of strong community leaders from across the community being inclusive and working hard for the benefit for the whole community.



## Case study in environmental resilience – ICOLLs

There are 28 estuaries in the Bega Valley Shire, 23 of which are intermittently closed or open lakes and lagoons or 'ICOLLs'. ICOLLs are characterised by periods of entrance closure, resulting in fluctuating water levels, changes in water chemistry and ecological variability.

Each ICOLL has evolved a unique ecology that is able to withstand long periods of closure (Wallagoot Lake has experienced a 14 year closure) and resultant changes in salinity. Being at the bottom of the catchment, our ICOLLs are vulnerable to catchment inputs and resultant nutrient fluctuations.

Periods of drought and flood also have dramatic physical impacts on ICOLLs. Despite these often dramatic fluctuations in ecological conditions, resident aquatic flora and fauna found in our ICOLLs has evolved to adapt to these conditions.

Following European settlement, catchment clearing, agriculture expansion and urban development has placed increasing pressures on ICOLL resilience. Low lying development, vital transport assets and recreational areas are subject to inundation during periods of closure, requiring Council to artificially open the entrance bars of ICOLLs such as Wallaga Lake, Back Lake and Lake Curralo.

This early intervention in the opening / closure cycles of ICOLLs has impacts on the estuary's ecology and the adjoining wetlands and fringing vegetation communities.

Despite the natural environmental fluctuations and human induced pressures on the ICOLLs they have maintained high levels of ecological health and biological production. The resilience of ICOLLs is an example of the resilience of natural systems to external shocks, pressures and environmental variability. This resilience will likely be tested by the projected impacts of climate change on our marine, estuarine and terrestrial ecosystems.



# Appendix 2

*Existing programs and strategies that support climate resilience*

Project / Program	Mitigation	Adaptation	Organisation
BVS Coastal Processes & Hazards Definition Study		x	BVSC
Bega Valley Shire CLEP 2013		x	BVSC
Bega Valley Shire DCP 2013	x	x	BVSC
Bega Valley Shire Climate Adaptation Risk Assessment	x	x	BVSC
Bega Valley Shire Climate Adaptation Strategy (2014 – 17)	x	x	BVSC
Bega Valley Shire Clean Energy Plan	x		BVSC
Bega River Estuary Management Plan		x	BVSC
Pambula Lake Coastal Management Plan		x	BVSC
BVSC Coastal Management Program – Coastal Hazards (Draft)		x	BVSC
Bermagui River Coastal Management Program (Draft)		x	BVSC
Lake Curalo Coastal Management Program (Draft)		x	BVSC
Merimbula Lake Coastal Management Plan (Draft)		x	BVSC
Wallaga Lake Coastal Management Plan (Draft)		x	BVSC
Bega Valley Shire Bushfire Risk Management Program		x	BVSC
BVSC Entrance Management Policy		x	BVSC
NSW RFS Bega Valley Bushfire Risk Management Plan	x	x	NSW RFS
NSW Marine Estate Management Strategy	x	x	MEMA
South East NSW Integrated Regional Vulnerability Assessment	x	x	OEH
Catchment Action Plan 2013 – 2023	x	x	LLS
South East Regional Strategic Weed Management Plan 2017-22		x	LLS
25% of Bega Valley Shire houses have Solar installations	x	x	Community
Drought Management Plan	x	x	Council
BVSC Waste Strategy	x	x	

# Appendix 3 - Climate resilience risk assessment

## Natural Systems Climate Resilience Risk Assessment

	Climate Change Impacts						
Key Vulnerabilities: Natural Systems	Sea Level Rise	Rainfall Variability	Increase in Average Temps.	Increased hot days (35+)	More intense storms	Change in ocean temp. & pH	Averaged Scores
Decline in tree canopy cover	1	5	5	4	2	N/A	3.4
Fragmentation of wildlife corridors	N/A	3	2	3	1	N/A	2.3
Biodiversity – threatened species	4	4	4	3	1	4	3.3
Bio-diversity – Invasive species (weeds)	1	3	3	2	1	2	2.0
Bio-diversity – Invasive species (fauna)	1	1	2	3	1	2	1.7
Length of coastline	5	3	2	2	4	4	3.3
Length of Estuarine foreshore	5	3	3	3	2	1	2.9
Estuary ecosystem health	5	4	4	4	3	5	4.2
Lack of riparian vegetation	3	5	5	3	4	N/A	4.0
Extent of dune systems	5	3	2	4	4	N/A	3.6

## Land use and Settlement Climate Resilience Risk Assessment

	Climate Change Impacts						
Key Vulnerabilities: Land use and Settlement	Sea Level Rise	Rainfall Variability	Increase in Average Temps.	Increased hot days (35+)	More intense storms	Change in ocean temp. & pH	Averaged Scores
Area of Nat Park or State Forests	2	5	4	4	3	2	3.3
Extent / location of agricultural land	1	5	5	5	4	N/A	4.0
Distribution / location of towns, villages and settlements	4	4	4	4	3	N/A	3.8
Location of rural residential development	1	5	4	4	3	N/A	3.4
Low lying development	5	4	1	1	4	1	2.7
Length of bushland / urban interface	N/A	5	5	5	3	N/A	4.5
Lack of connectivity between and within settlements	2	1	3	4	4	N/A	2.8
Vehicle dependence	N/A	N/A	3	5	4	N/A	4.0
Lack of public transport	N/A	N/A	3	5	2	N/A	3.3
Limited housing styles	N/A	N/A	2	4	2	N/A	2.7
Reliance on major towns	4	3	3	4	3	N/A	3.4

## Infrastructure Climate Resilience Risk Assessment

	Climate Change Impacts						
Key Vulnerabilities: Infrastructure	Sea Level Rise	Rainfall Variability	Increase in Average Temps.	In-creased hot days (35+)	More intense storms	Change in ocean temp. & pH	Averaged Scores
Extent of Bitumen Road Network	3	3	5	5	3	1	3.3
Extent of Gravel Road Network	3	4	4	3	4	N/A	3.6
Low lying water and sewer infrastructure	5	4	2	N/A	4	N/A	3.8
Location of airport	4	3	1	1	4	N/A	2.6
Water supply system	3	4	3	3	3	N/A	3.2
Capacity of stormwater network	4	4	1	1	4	1	2.5
Linear power network	1	2	5	5	4	N/A	3.4
Council's asset portfolio	4	3	4	4	3	1	3.2
Telecommunication infrastructure	N/A	N/A	4	4	4	N/A	4.0
Distribution of recreational assets	4	3	3	3	3	N/A	3.2
Condition of major highways	N/A	1	1	1	1	N/A	1.0
Number of bridges and culverts	3	4	3	3	4	1	3.0
Management of waste products	1	3	3	4	3	N/A	2.8

## Economy Climate Resilience Risk Assessment

	Climate Change Impacts						
Key Vulnerabilities: Economy	Sea Level Rise	Rainfall Variability	Increase in Average Temps.	In-creased hot days (35+)	More intense storms	Change in ocean temp. & pH	Averaged Scores
Lack of industry diversity	1	3	1	3	3	3	2.3
Reliance on major employers incl. Gov.	N/A	N/A	N/A	N/A	N/A	1	1.0
Dairy – water access	2	5	4	5	3	N/A	3.8
Dairy – irrigation costs	N/A	5	4	5	2	N/A	4.0
Dairy – production costs /commodity prices	N/A	5	4	5	2	N/A	4.0
Beef – commodity prices	N/A	4	4	5	2	N/A	3.8
Tourism - seasonality	N/A	4	4	4	4	3	3.8
Tourism – market competition	3	1	3	3	3	N/A	2.6
Tourism - reliance on natural env.	4	4	4	4	3	2	3.5
Distance from markets	N/A	N/A	2	1	2	N/A	1.7
Reliance on external food and commodities	N/A	4	4	4	3	3	3.6
Reliance on external energy production	N/A	N/A	3	5	5	N/A	4.3
Aquaculture – ecosystem health	4	4	4	5	3	5	4.2
Internet access / quality	N/A	N/A	N/A	N/A	2	N/A	2.0
Online shopping / retail trends	N/A	N/A	N/A	N/A	N/A	N/A	#DIV/0!
Reliance on road transportation	3	3	3	4	3	N/A	3.2



	Climate Change Impacts						
Key Vulnerabilities: Our Community	Sea Level Rise	Rainfall Variability	Increase in Average Temps.	Increased hot days (35+)	More intense storms	Change in ocean temp. & pH	Averaged Scores
Ageing population	N/A	N/A	4.0	5.0	4.0	N/A	4.3
Limited education & training opps.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Limited employment opportunities	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Availability of specialist medical services	N/A	N/A	3	3	2	N/A	2.7
Absentee property owners	N/A	3	N/A	N/A	2	N/A	2.0
Rates of volunteerism	N/A	3	3	4	4	N/A	3.7
Reliance on social and community networks	N/A	3	2	3	3	N/A	2.7
Lack of cultural diversity	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Housing affordability	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Income inequality	N/A	N/A	N/A	3	N/A	N/A	3.0
Integration of new residents	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cost of living pressures	N/A	N/A	3	4	2	0	2.3
Disability services	0	0	3	4	0	0	1.8
Long term knowledge and skill availability	0	3	3	3	3	0	2.3

# Appendix 4

## Bega Valley Shire vulnerabilities

The following tables list the existing environmental, physical and socio-economic vulnerabilities that characterise our Shire and community. These vulnerabilities were identified through workshop sessions with Council's community technical advisory panel, existing research, Council staff and industry experts. A range of existing stressors and historic shocks have been identified to which the vulnerabilities have some level of sensitivity or exposure. Climate change is predicted to exacerbate the severity of these stressors and shocks and hence increase our vulnerability. The climate change factors predicted to impact individual vulnerabilities are highlighted

Key Vulnerabilities		Existing Stressors							Historic Shocks						
		External Economy Factors	Local Economy	Under employment	Low Median Income	Housing Avail-ability	Energy Price	Natural Resource Use	Drought	Heat Wave	Bushfire	Flood	Storm / ECL	Coastal Erosion	Industry Closure /restruc.
Natural Systems															
Percentage of forest cover across Shire								RN	RN TP	TP	TP RN				
Loss of wildlife corridors									RN TP		TP HD				
Biodiversity – threatened species									RN TP	OT TP	TP RN	SL RN		SL ST	
Bio-diversity – Invasive species (weeds)									RN TP	OT TP	TP RN	SL RN			
Bio-diversity – Invasive species (fauna)									RN TP	OT TP	TP RN				
Length of coastline										OT		SL RN	SL RN ST	SL ST	
Length of Estuarine foreshore									RN TP	OT TP		SL RN	SL RN ST		
Estuary ecosystem health									RN TP	OT TP		SL RN	SL RN ST	SL ST	
Degraded catchments									RN TP	RN TP HD	TP RN HD	RN	ST RN		
Dune systems									RN TP		TP OT		ST SL	SL ST	

Predicted climate change factors that will exacerbate existing stressors and shocks	Sea level rise	SL
	Changes in ocean temp and pH	OT
	Increased rainfall seasonality	RN
	Increased average temperatures	TP
	Increased hot days (35 deg+)	HD
	More intense storms	ST

Key Vulnerabilities		Existing Stressors								Historic Shocks					
		External Economy Factors	Local Economy	Under employment	Low Median Income	Housing Avail-ability	Energy Price	Natural Resource Use	Drought	Heat Wave	Bushfire	Flood	Storm / ECL	Coastal Erosion	Industry Closure /restruc.
Infrastructure															
Extent of Bitumen Road Network										TP HD		RN ST	SL RN ST	SL ST	
Extent of Gravel Road Network									RN TP			RN ST	SL RN ST		
Low lying water and sewer infrastructure												SL RN	SL RN		
Location of airport												SL RN ST	SL RN ST		
Water supply system								RN TP	RN TP	TP HD	TP HD	RN	SL RN		
Capacity of stormwater network												SL RN	SL RN	SL RN	
Linear power network										TP HD	TP HD	RN	RN		
Council's asset portfolio								RN	RN TP	TP HD	TP HD	SL RN	SL RN	SL RN	
Telecommunication infrastructure										TP HD	TP HD	RN	RN		
Distribution of recreational assets								RN	TP	TP HD	TP HD	SL RN	SL RN	SL	
Condition of major highways								RN				SL RN	SL RN		
Number of bridges and culverts								RN				SL RN ST	SL RN ST	SL ST	
Management of waste products											RN TP	RN			

Predicted climate change factors that will exacerbate existing stressors and shocks	Sea level rise	SL
	Changes in ocean temp and pH	OT
	Increased rainfall seasonality	RN
	Increased average temperatures	TP
	Increased hot days (35 deg+)	HD
	More intense storms	ST



Key Vulnerabilities			Existing Stressors							Historic Shocks						
	External Economy Factors	Local Economy	Under employment	Low Median Income	Housing Avail-ability	Energy / fuel Price	Natural Resource Use	Drought	Heat Wave	Bushfire	Flood	Storm / ECL	Coastal Erosion	Industry Closure /restruc.		
Land use and Settlement																
Location of rural residential development									HD	TP RN HD	SL RN ST	SL RN ST				
Extent / location of agricultural land							RN	HD TP RN	HD TP	TP RN	RN					
Area of Shire within NP or State Forests								RN TP		HD TP RN	RN	SL RN	SL			
Distribution / location of towns, villages & settlements								RN		TP RN	SL RN	SL RN	SL			
Low lying development											SL RN	SL	SL			
Length of bushland / urban interface								HD TP RN	HD TP RN	HD TP RN						
Lack of connectivity between and within settlements									HD	TP						
Vehicle dependence									HD TP	TP						
Lack of public transport									HD TP							
Limited housing styles																
Reliance on major towns										HD TP		SL				

Predicted climate change factors that will exacerbate existing stressors and shocks	Sea level rise	SL
	Changes in ocean temp and pH	OT
	Increased rainfall seasonality	RN
	Increased average temperatures	TP
	Increased hot days (35 deg+)	HD
	More intense storms	ST

Key Vulnerabilities			Existing Stressors						Historic Shocks					
	External Economy Factors	Local Economy	Under employment	Low Median Income	Housing Availability	Energy / fuel Price	Natural Resource Availability	Drought	Heat Wave	Bushfire	Flood	Storm / ECL	Coastal Erosion	Industry Closure /restruc.
<b>Economy</b>														
Lack of industry diversity							RN	RN TP			RN			
Reliance on major employers including Gov.														
Dairy – water access		RN					RN	RN TP			RN			
Dairy – irrigation costs	RN													
Dairy – production costs /commodity prices	RN	RN					RN	RN TP			RN			
Beef – commodity prices	RN	RN					RN	RN TP						
Tourism - seasonality		RN TP					TP	RN TP	TP HD	RN	RN			
Tourism – market competition														
Tourism - reliance on natural environment		RN					RN	RN		RN	SL RN	RN	SL	
Distance from markets							RN				RN ST			
Reliance on external food and commodities	RN	RN						RN TP			RN ST			
Reliance on external energy production	ST	ST				ST								
Aquaculture – ecosystem health		RN					RN OT TP	RN TP	OT RN		RN	SL RN ST	SL	
Internet access / quality														
Online shopping / changing retail trends														
Reliance on road transportation										RN	RN ST	ST		

Predicted climate change factors that will exacerbate existing stressors and shocks	Sea level rise	SL
	Changes in ocean temp and pH	OT
	Increased rainfall seasonality	RN
	Increased average temperatures	TP
	Increased hot days (35 deg+)	HD
	More intense storms	ST

Key Vulnerabilities		Existing Stressors								Historic Shocks					
		External Economy Factors	Local Economy	Under employment	Low Median Income	Housing Avail-ability	Energy / fuel Price	Natural Resource Availability	Drought	Heat Wave	Bushfire	Flood	Storm / ECL	Coastal Erosion	Industry Closure /restruc.
Our Community															
Ageing population										TP HD					
Limited education & training opportunities															
Limited employment opportunities															
Availability of specialist medical services															
Absentee prop. owners											RN TP	RN	RN ST		
Reduced volunteerism								RN TP		TP HD	RN TP	RN	RN ST		
Reliance on social and community networks								RN TP	TP	TP HD	RN TP	RN	RN ST		
Lack of cultural diversity															
Housing affordability															
Income inequality															
Integration of new residents															
Cost of living pressures							TP HD			TP HD					
Disability services															
Long term knowledge and skill availability									TP	TP HD	RN TP	RN	RN ST	ST	

Predicted climate change factors that will exacerbate existing stressors and shocks	Sea level rise	SL
	Changes in ocean temp and pH	OT
	Increased rainfall seasonality	RN
	Increased average temperatures	TP
	Increased hot days (35 deg+)	HD
	More intense storms	ST



