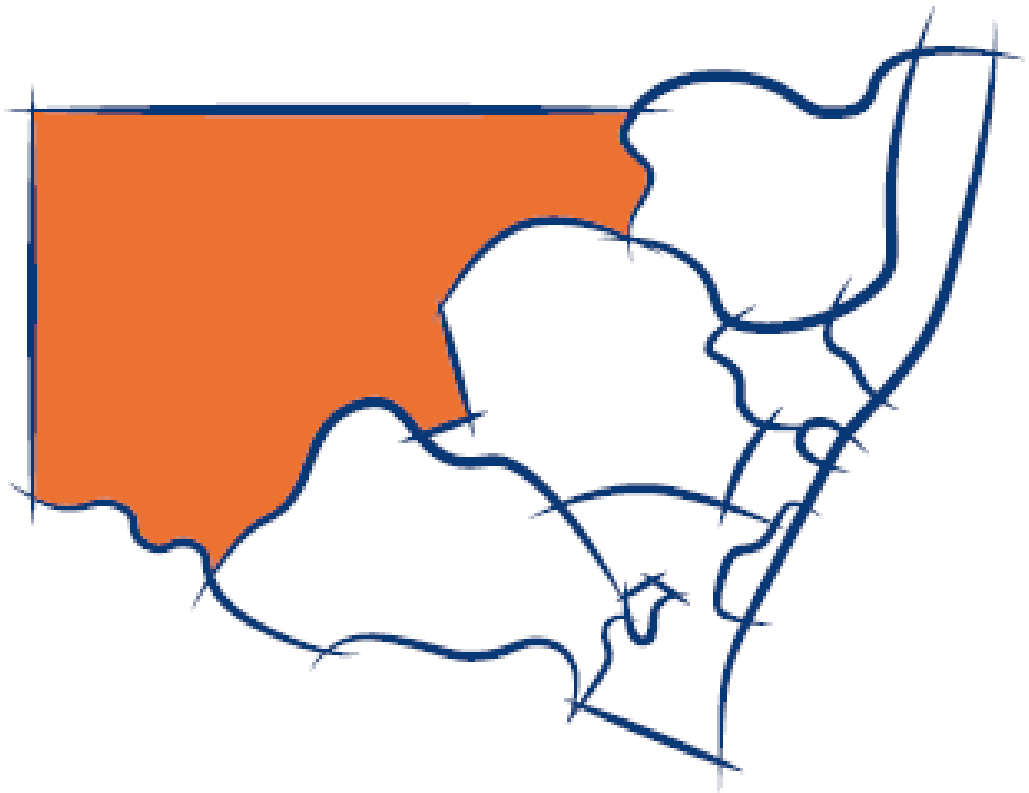
NSW GOVERNMENT Office of Environment & Heritage

AdaptNSW

Western Enabling Regional Adaptation

Far West region report



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Contents

List of figures

List of tables

1 Introduction

The climate is changing and global modelling indicates that further change is already locked in. As a result there is a growing risk of climate related impacts on our state's natural, social and economic systems. Regional administrators, businesses and communities need to identify their strengths and weaknesses in the face of climate impacts – deciding how they will act together to minimise the impact of climate change on their local economy, environment and society.

Climate affects multiple systems and so risks from climate require a systemic, coordinated response. From a practical perspective, this requires input, agreement and collaboration of multiple stakeholders, amongst whom there may be no history of cooperation. In partnership with leading researchers, the Office of Environment and Heritage (OEH) has developed and delivered processes that enable regional scale consideration of climate projections and investigation of related impacts.

The Western Enabling Regional Adaptation (WERA) project builds on local knowledge to understand climate vulnerabilities in Western NSW and identify opportunities to respond, enabling regional decision-makers to enhance government service delivery and planning at a regional and subregional scale.

The WERA project provides a structured process for participation by representatives of NSW Government agencies, local government stakeholders, using their tacit local knowledge to identify and capture opportunities to build regional resilience. By enabling participatory learning, the WERA process develops new and expanded professional networks which can be mobilised to respond to climate change. This operational knowledge of how regional systems interact informs the development of adaptation responses that are sensitive to the reality of local systems.

The WERA project has sought to:

- provide a credible evidence base for Government adaptation planning by developing a regional understanding of the impacts of projected climate change and vulnerability to the expected impacts for the Far West region
- build on the capacity of regional decision-makers to undertake adaptation action by improved understanding of regional climate change impacts, adaptive capacity, vulnerability and adaptation options, and
- strengthen relationships between sectors across local and state government in the four western regions, with a view to capturing opportunities for regional climate change adaptation projects.

This report presents the output from a series of workshops held in the Far West region during 2016. Workshop participants developed transition pathways for key regional systems, to build resilience to climate extremes and minimise impacts on their local communities.

The report also outlines the workshop process, and potential projects to activate the transition pathways and strengthen key regional systems in the Far West, and support improved government service planning and delivery now and into the future. The final chapter of the report gives proactive ways to turn the report's findings into action.

2 What needs to change in the Far West region?

2.1 Identification of vulnerable regional systems

The state's regions are subject to a broad range of drivers of change (economic, technological, social and environmental). Regions such as the Far West are made up of many component parts (or systems) that all contribute to how the region currently functions (business-as-usual) and its trajectory of future development. A region's resilience in response to drivers of change relies on its capacity to adapt. For temporary drivers (such as fluctuations in agricultural commodity prices), basic alterations to business-as-usual may be an adequate response; however, for persistent and disruptive drivers such as climate change, more fundamental and transformative change may be required to adapt regional systems.

For the Far West, seven regional systems were identified by participants as particularly vulnerable and in need of change to ensure effective ongoing government service planning and delivery:

- Far West towns
- economic development
- tourism
- water
- rangeland grazing and conservation on private lands
- energy
- Far West reserve system.

2.2 Transition models for key regional systems

For each of the key regional systems identified, a change model was developed to describe:

1. the regional system (or set its boundaries)
2. the most important drivers acting on the system, which currently may not be climate related; however, the impacts of non-climate drivers will likely be amplified by climate change
3. business-as-usual (or the way the system currently operates)
4. a series of transition pathways that emerge from business-as-usual in response to the need for change
5. a desirable future system, transformed by progress along the transition pathways.

Far West towns

Far West towns are small remote communities separated by large distances. Broken Hill is the largest town, servicing a population of around 18,000 people as well as providing services to the broader region. The Far West is unique in that many of its service centres are located outside the region (e.g. Dubbo, Mildura, Adelaide). The future development of Broken Hill and stabilising populations in the smaller communities will be critical to supporting transformational change throughout the region.

The Far West towns model presented below refers mainly to Broken Hill, although elements of the model apply to other towns in the region, and call for strengthened settlements with coordinated physical and social infrastructure adapted to climate and community needs (Figure 1).

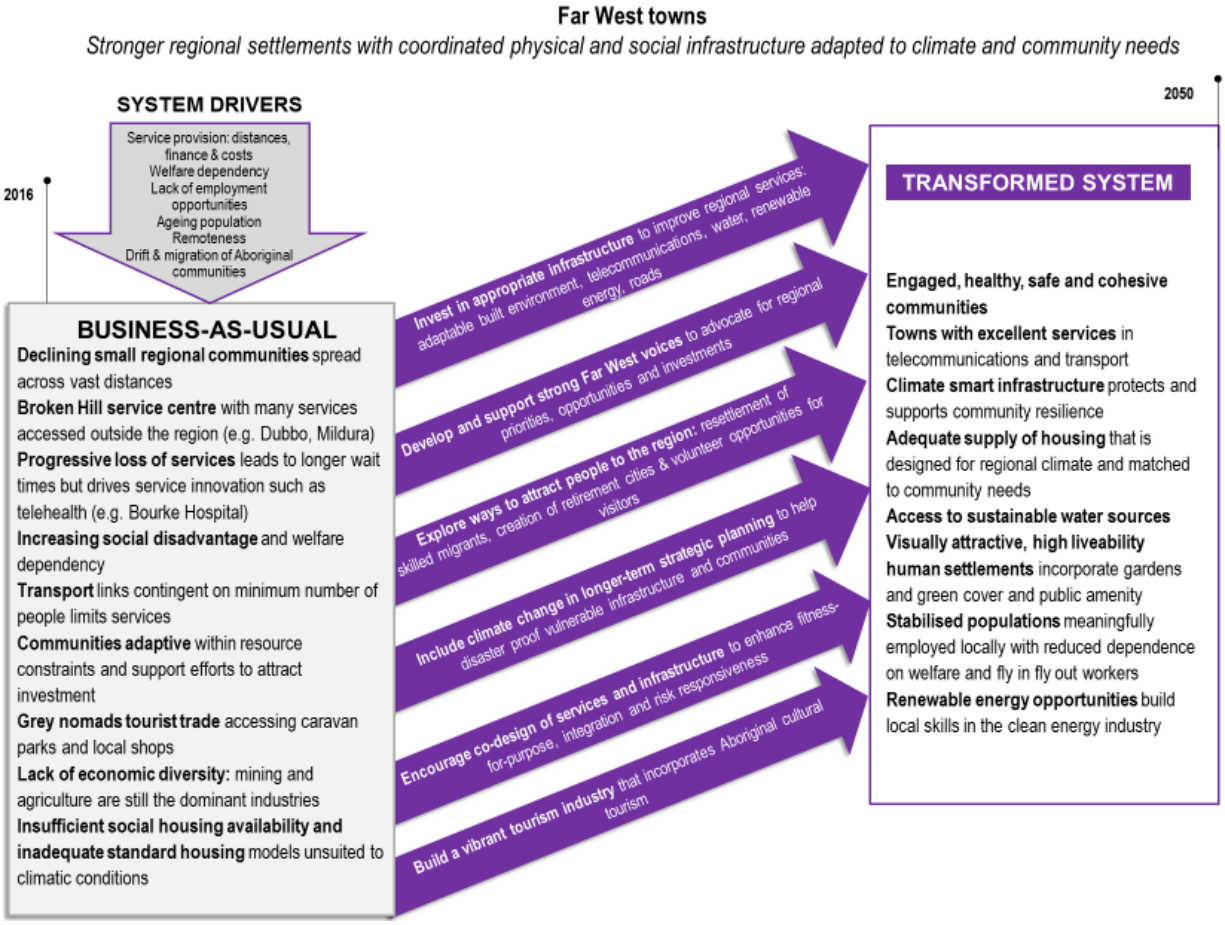

Figure 1: Change model for Far West towns

Far West towns are influenced by a range of biophysical, economic and social drivers including demographic change resulting from the drift of Aboriginal communities to regional centres, general population loss and ageing. These drivers are linked to welfare dependency and lack of employment opportunities. The remoteness of the region reinforces difficulties with service provision.

Broken Hill is the major service centre located in the Far West with the region's smaller settlements struggling to remain viable and reliant on Broken Hill (and Dubbo and Mildura for those in the north, east and south of the region) for professional, technical and public sector services. This progressive loss of services has led to longer wait times, frustration and increase in social disadvantage. In addition, the community lacks access to adequate infrastructure such as housing, which is unsuited to the region's climate, and transport links. A lack of economic diversity leads to the heavy reliance on mining and agriculture as the major regional industries, and dependence on government funding, which is subject to government restructures and reform. 'Grey nomads' provide some economic contribution through caravan based tourism; however, communities are adaptive within resource limitations and they support efforts to attract investment to the region.

Pathways leading to a transformed future for Far West towns include the co-design of and investment in services and infrastructure to improve comfort in the built environment and access to essential services such as telecommunications, water, clean energy and transport.

This would require the incorporation of climate change in long-term strategic planning to help disaster proof vulnerable communities and infrastructure. The declining regional population could be addressed through exploration of options to attract people to the region such as the resettlement of skilled migrants, creation of retirement cities and volunteer opportunities for visitors. Regional advocacy would be improved through development and support of strong regional voices to ensure the region's priorities, opportunities and investments were promoted. A vibrant tourism sector that incorporates Aboriginal cultural experiences would aid economic diversification.

A transformed future for Far West towns envisions communities that are engaged, healthy, safe and cohesive, sustained by climate smart infrastructure that protects and supports community resilience. Human settlements are visually attractive and liveable and incorporate green cover and public amenity serviced by adequate infrastructure to deliver water, telecommunications and transport. Renewable energy provides a secure and reliable energy supply and creates skilled employment opportunities in clean energy. Diversification of the economy through the creation of new industries provides meaningful employment and attracts investment to the region.

Economic development

Under the change model economic development for the Far West was defined as an economy that supports self-determination of a defined region with a coherent identity (Figure 2).

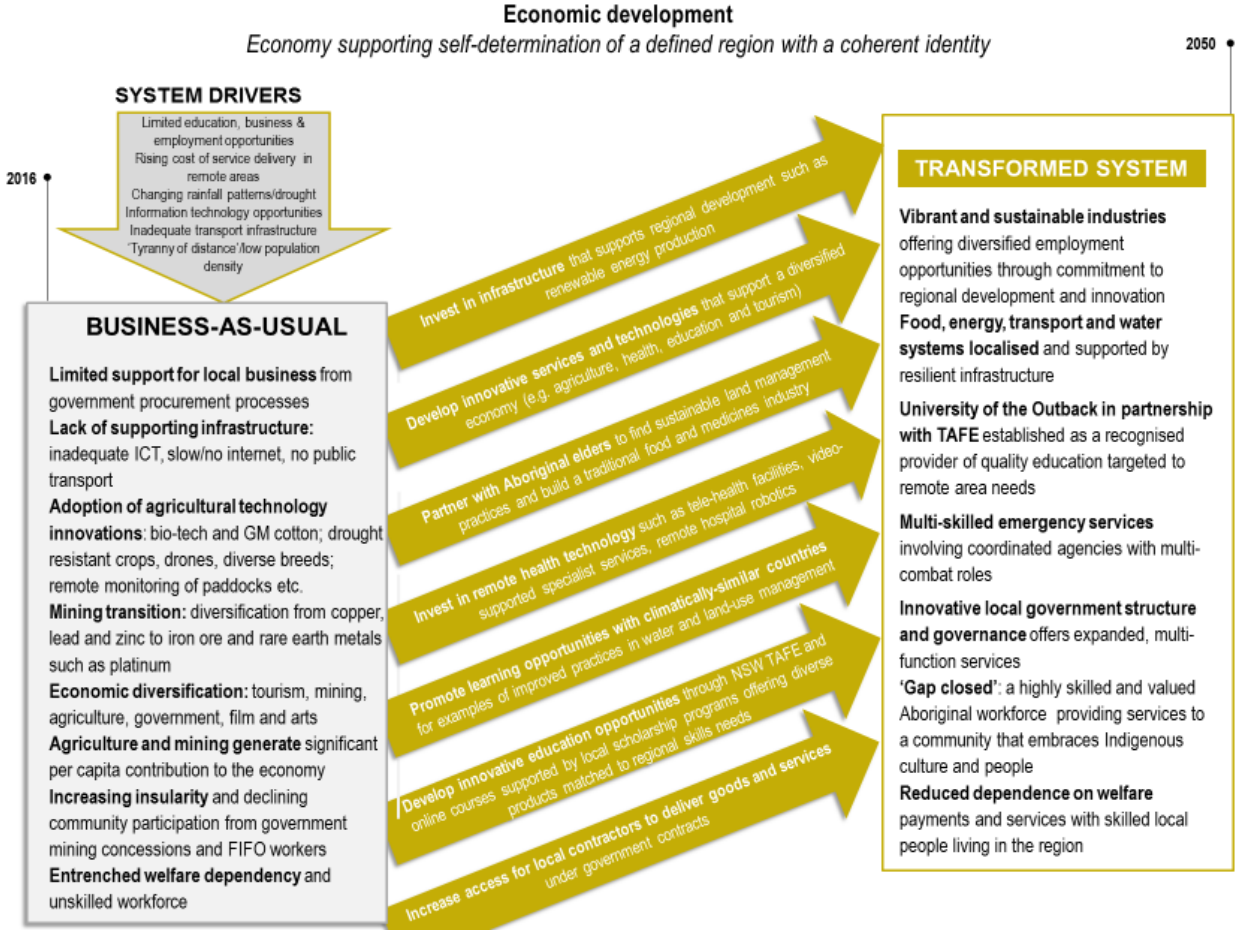

Figure 2: Change model for economic development

The region's economic development is influenced by remoteness ('the tyranny of distance') from the rest of NSW and low population density. Inadequate transport infrastructure adds to the high cost of service delivery. Climate influences economic development through changes in rainfall patterns and frequent droughts. While opportunities in education, business and employment face limitations, information technology provides opportunities for regional development.

While economic development is currently constrained by a lack of supporting infrastructure (particularly telecommunications, internet and public transport) the region's traditional industries are responding to drivers of change through the adoption of innovative technology, in the case of the agriculture sector, and by diversifying the types of mineral resources extracted in the mining sector. Moreover, tourism, film and arts based activity is broadening the economic base. However, the region is suffering from insularity, welfare dependency and declining participation in the community from drive-in-drive-out state government service providers and fly-in-fly-out (FIFO) workers in the mining sector.

Pathways to a transformed future for the Far West rest on greater investment in infrastructure (especially renewable energy production) and innovative service delivery (for agriculture, health, education and tourism) that support economic diversification and regional development. Regional health would benefit from investment in a range of technologies including tele-health facilities and remote hospital robotics. Similarly, education services would benefit from greater exploitation of online course delivery to fill regional skills gaps, supported by local scholarships programs. Local employment opportunities could be enhanced through an easier procurement process for local contractors to deliver goods and services under government contracts. The Far West would also benefit from the development of learning opportunities in land and water management together with arid zone regions globally.

By 2050, the Far West economy is envisioned to be supported by vibrant and sustainable industries offering diversified employment opportunities through a commitment to regional development and innovation. Dependency on welfare will be reduced and the community will be serviced by a skilled and valued workforce. Resilient infrastructure will support local food, energy, transport and water systems. Local government will offer expanded, multifunctional services through innovative structures and governance arrangements. Emergency service personnel will be multi-skilled and agencies coordinated to perform multiple combat roles with a focus on disaster mitigation and preparedness.

Tourism

The tourism sector in the Far West was defined under the change model as essential to support and grow the visitor economy to Broken Hill and throughout the region (Figure 3).

Major drivers on the sector include remoteness of tourist destinations in the region, lack of accessibility via road transport, closures of local businesses during off peak season reducing services on offer and, increasingly, the impacts of heat on human comfort and visitor safety. Positive influences include the region's unique natural and cultural heritage and dark night skies, which favour the development of 'sky tourism'.

Currently, the region has a strong brand and online presence being among the top most searched tourism destinations in NSW. However, tourism to the region is limited by the large distance from major cities and infrequent train services, limited and expensive flights and unsealed roads which constrain access. Tourism opportunities and assets are undervalued and the limited regional presence of Destination NSW fails to capitalise on the efforts of local government and tour operators to promote the diversity of tourism experiences on offer.

Major events such as the St Patrick's Race Meeting are constrained by the lack of accommodation options to cater for increased short-stay demand. Regional climate limits tourism to the cooler months of the year.

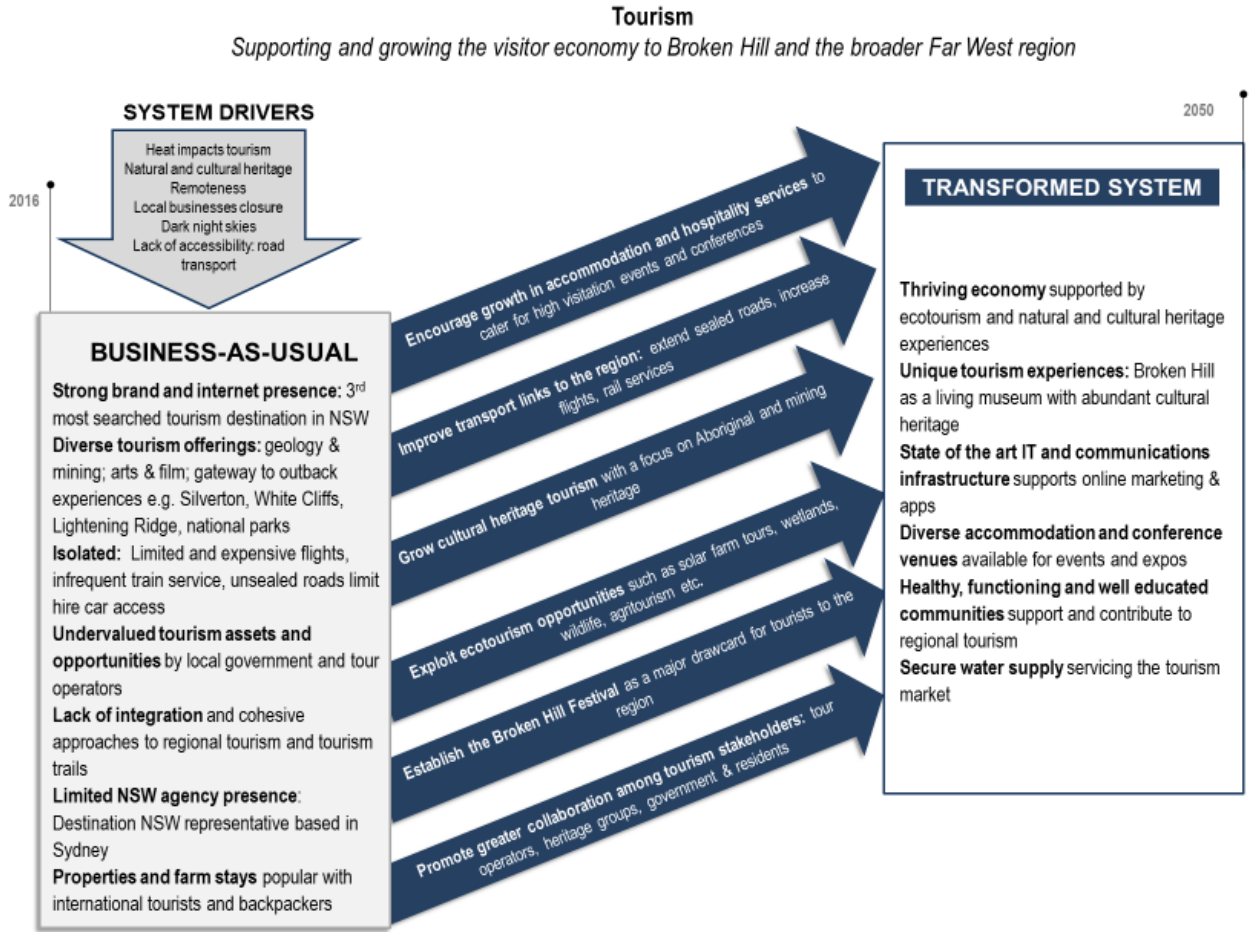

Figure 3: Change model for tourism

Pathways leading to a transformed tourism industry focus on the diversification of tourism offerings through development of ecotourism opportunities (e.g. solar farm tours, visits to wetlands, wildlife tourism, farm stays and agritourism). Promotion of cultural heritage tourism, such as Aboriginal bush foods and medicines and mining heritage would increase visitation. In addition, regional event tourism would be further boosted by the establishment of an annual Broken Hill Festival showcasing the city's national heritage and creating the concept of a living museum. Accommodation and hospitality services would be required to cater for higher visitation at events and conferences. Greater collaboration among all tourism stakeholders is required to support all transition pathways.

A transformed future envisions tourism contributing to a thriving regional economy that supports healthy communities. The region is a major tourist drawcard through the wealth of unique tourism experiences on offer and diverse accommodation and conference venues. Modern and fast IT and communications infrastructure underpins the industry and allows for increased online marketing and bookings, supported by secure water supplies and improved transport links to enable increased access for tourists.

Water

Settlements throughout western NSW are strongly influenced by the availability of and demand for water resources. Secure water supply underpins the prosperity of the region and the focus of this model is the continued supply of water to service multiple uses (Figure 4).

Major drivers on the water system include water sharing plans and processes, changing rainfall patterns and climate, reduced inflows to storages and the loss of groundwater resources and bore fields. Other drivers include the need to address how competing users access water and the region's ageing water infrastructure. System management to maintain environmental flows is also an important driver addressed through water sharing plans.

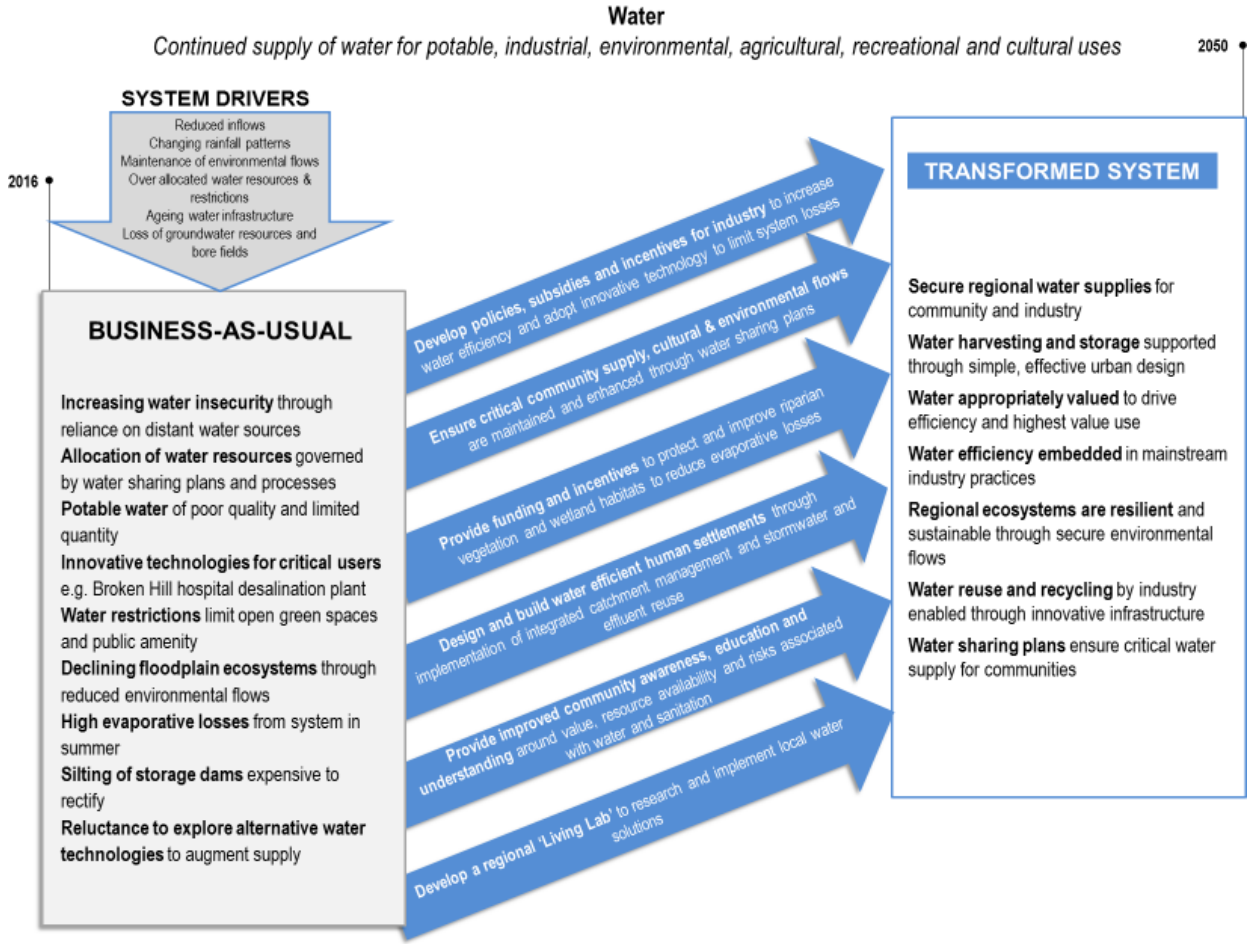

Figure 4: Change model for water

The water system in the region is vulnerable due to reliance on distant water sources. Allocation of water resources is governed by water sharing plans. Potable water is often of poor quality and in limited supply. The use of water restrictions to manage demand constrains the use and effectiveness of open green spaces and public amenity (such as sporting fields). Water distribution suffers from high evaporative losses in summer with floodplain ecosystems and aquatic species in ecological decline because of reduced environmental flows. Storage systems are under stress from the silting of dams. Despite the supply-side restrictions and ageing infrastructure there appears to be a reluctance to explore alternative water technologies to augment supply.

Transition pathways for the water system include the development of policies, subsidies and incentives for industries to increase water efficiency and adopt innovative technologies to limit system losses. The establishment of a regional 'Living Laboratory' would foster research and development into local water solutions, and allow innovative technologies to be trialled

and implemented. Greater effort to design water efficient towns that enable the fit-for-purpose reuse of stormwater and effluent could be achieved through the implementation of integrated catchment management. Greater water efficiency in human settlements would be complemented by programs aimed at increasing community awareness, education and understanding of the value, availability and risks associated with water and sanitation. Maintenance and enhancement of cultural and environmental flows under water sharing plans would support the health and function of regional ecosystems. This can be achieved by sourcing, funding and creating incentives that encourage the protection of riparian vegetation and wetland habitats to reduce evaporative losses and maintain water availability in the landscape.

A transformed system sees regional water resources governed under water sharing plans secured for the community, industry and the environment using effective urban design and efficient infrastructure. Water is appropriately valued to drive efficiency and highest value use. Environmental flows are secure and support resilient, sustainable regional ecosystems. Appropriate infrastructure supports the improved water harvesting and storage with losses from the system minimised.

Rangeland grazing

The change model's definition of the rangeland grazing system in the Far West reflects the growing recognition that healthy ecosystems both support biodiversity and enhance food security (Figure 5).

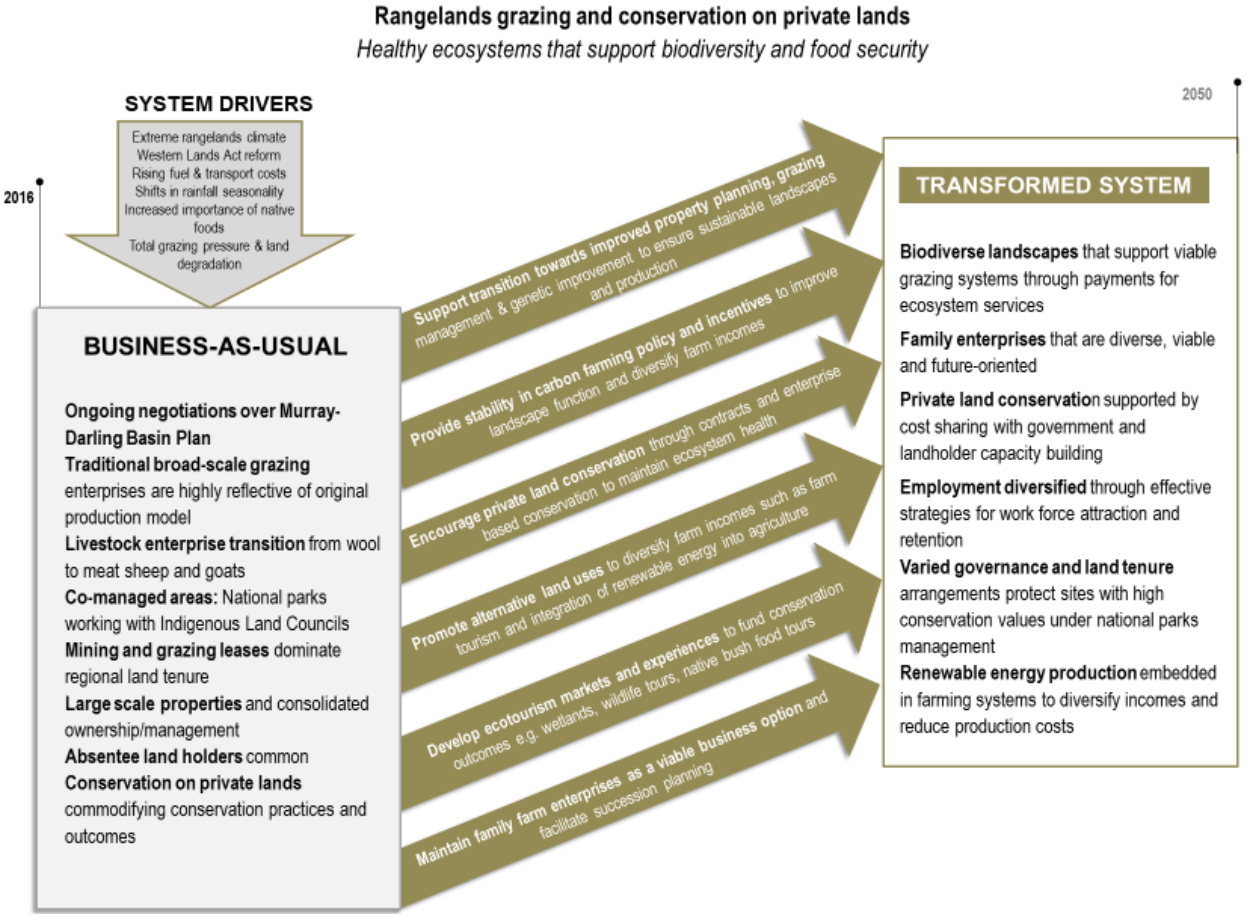

Figure 5: Change model for rangeland grazing and conservation on private lands

Major drivers on the region's grazing system relate primarily to changes in the natural resource availability, rising input costs and social factors influencing farming communities. Changes in rainfall seasonality, land degradation and the extreme rangelands climate were seen as the major natural resource drivers. Other drivers include reform of the Western Lands Act, rising fuel and transport costs and increased interest in native foods.

Rangeland grazing systems are characterised as traditional broad-scale grazing enterprises that utilise native vegetation resources. Many livestock enterprises have transitioned from wool to meat sheep and more recently to goat production in response to market opportunities. Mining and grazing leases dominate regional land tenure and absentee landholders are common. The National Parks and Wildlife Service (NPWS) works with Indigenous Land Councils to co-manage areas for conservation. In addition, payments to landholders for conservation on private lands are commodifying conservation practices and outcomes.

Change in rangeland grazing and conservation could be promoted through pathways that facilitate improvements in livestock management and genetics and a transition towards low input livestock systems. The maintenance of family farm enterprises as a viable business option would be achieved through the diversification of income streams into complementary businesses such as farm tourism and carbon farming. Operating costs for farming could be lowered through the continued integration of renewable energy into agriculture. Ecosystem health could be maintained through enterprise-based conservation, capitalising on the $240 million committed by the NSW Government for private land conservation under the Biodiversity Conservation Trust. In addition, expansion of carbon farming and ecotourism experiences (e.g. wetlands, wildlife tours and native bush food tours) can fund conservation works and enhance ecosystem health and biodiversity.

A viable transformed grazing system is envisioned as diverse, future-oriented family farms operating in biodiverse landscapes and supported through payments for ecosystem services. Government in partnership with landholders shares the cost of conservation on private land. Adaptive tenure and governance arrangements are employed to protect high conservation value sites under NPWS management. The workforce is attracted and retained through diversified employment opportunities. Incorporation of renewable energy into farming systems has diversified farm incomes and lowered production costs.

Energy

Under the change model, the regional energy system is defined as localised, renewable, efficient and reliable (Figure 6).

Major drivers on the energy system include rising energy costs stimulating improvements to energy efficiency, requirements to reduce carbon emissions, risks to energy security and reliability, and technological innovation in energy generation and storage. Change in the system is restricted by a lack of investment in renewable energy generation and through the action of vested interests in the fossil fuel sector.

The regional energy system is currently characterised as centralised, fossil fuel intensive generation that is inefficient due to the high losses incurred in transmission. The costs to service and maintain the grid are increasing, which in turn is passed on to consumers, resulting in a high proportion of disposable income being spent on energy bills. The current system is highly vulnerable to damage from extreme climate events. However, the region has a high solar potential given its extensive sunshine and there is a growing penetration of renewables with the recent completion of the Broken Hill solar power plant, with a capacity of 53 megawatts, and the Silverton wind farm. Current building codes do not support energy efficiency and existing structures demand high levels of energy to maintain human comfort.

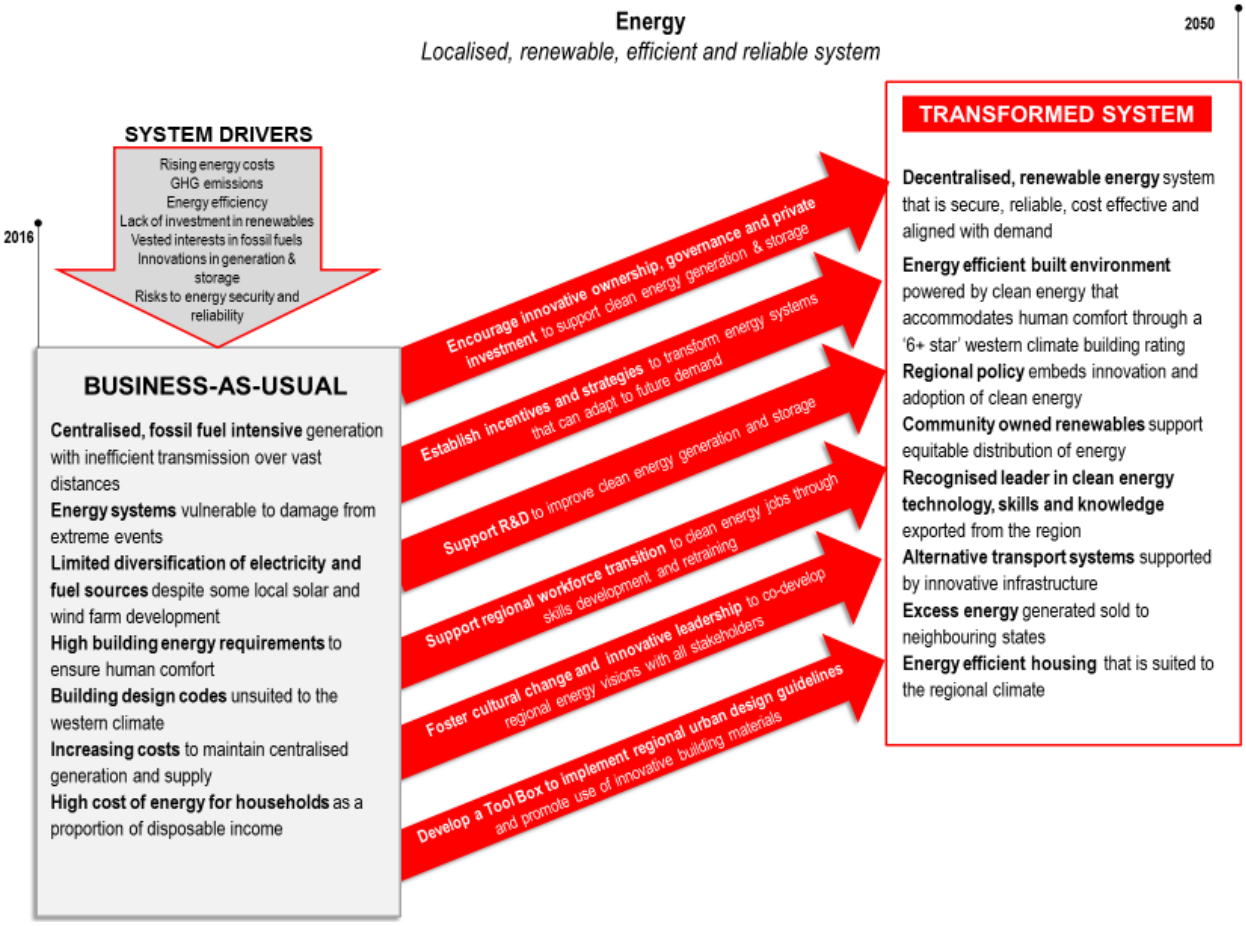

Figure 6: Change model for energy

Transition pathways recognise the need to transform the energy system to be more affordable, clean and reliable. This could be achieved via the implementation of complementary pathways providing incentives and strategies to invest in renewables and energy efficiency as well as research and development to foster innovation in clean energy generation and storage. The co-development of regional energy visions with all stakeholders requires significant cultural change and innovative approaches that can encourage community participation, innovative governance models and private investment. Skills development and retraining would support regional workforce transition to clean energy jobs and diversification of the regional economy. Lastly, human health and comfort would be enhanced through the adoption of novel building materials and locally relevant building design guidelines more suited to the extremes of the climate of the Far West region.

A transformed energy system is based on decentralised, renewable generation that is secure, reliable and cost effective. Buildings are efficient and powered from clean energy sources, accommodating human comfort through a '6+ star' western climate building rating. Community ownership of renewable generation supports the equitable distribution of energy and reduces energy poverty. Local transport is 'green' and active, and infrastructure such as wireless charging stations is accessible, to support the widescale uptake of electric vehicles. The Far West is a recognised leader in clean energy technology, skills and knowledge, and has entered the market as an energy provider to neighbouring regions.

Far West reserve system

The Far West reserve system is essential under the change model to maintain diverse natural and cultural values integrated across private land and the NSW reserve system (Figure 7).

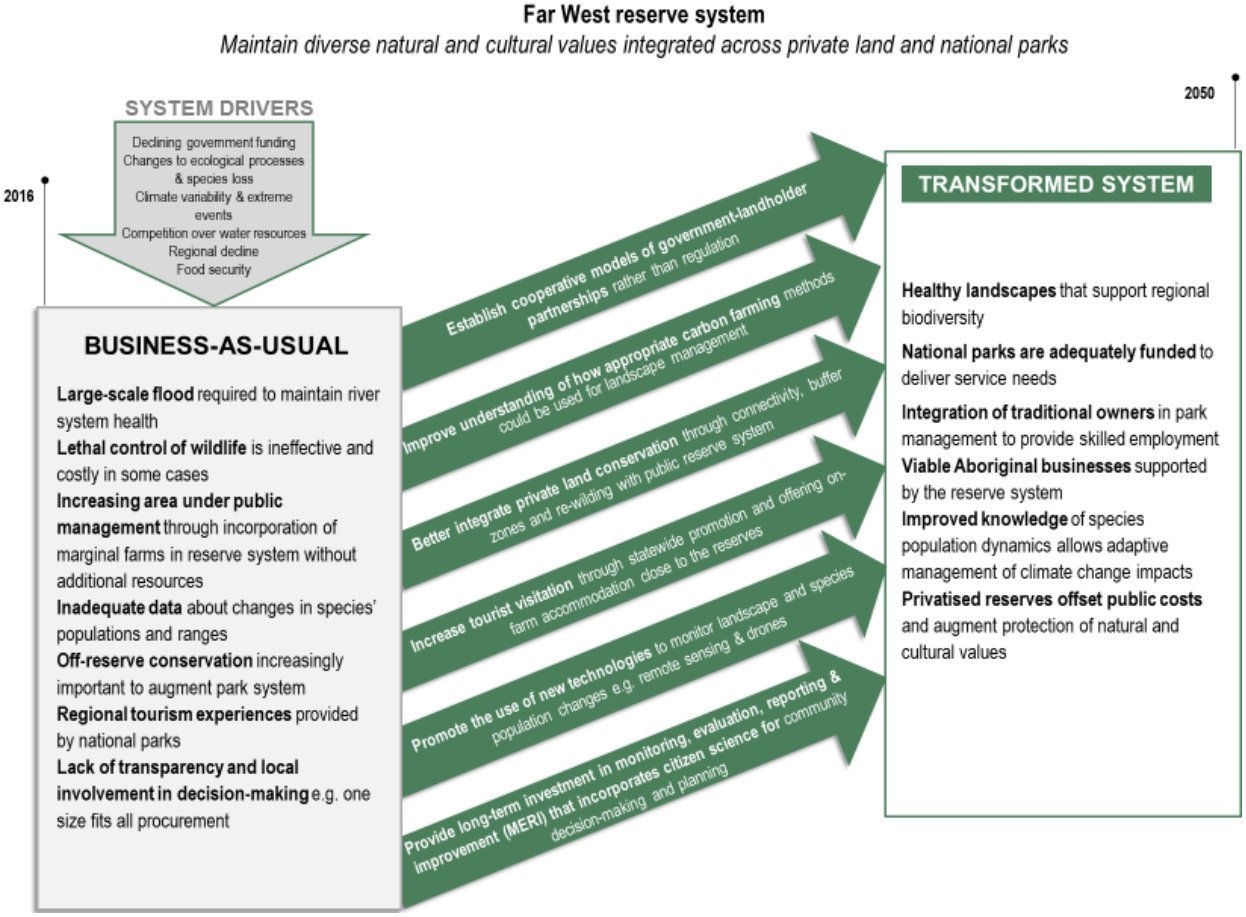

Figure 7: Change model for Far West reserve system

The Far West reserve system is a drawcard for tourists; however, the operation of the reserve system is under strain from the increasing area under public management without a commensurate increase in resources. The region is experiencing climatic shifts which exacerbate species loss. This increases the importance of off-reserve conservation to augment the reserve system by providing buffer zones and corridors to facilitate the movement and adaptation of species. However, action is being constrained by inadequate and out-of-date data needed to track changes in species population and range. Traditional methods of animal control (non-native and native 'pest' species) using lethal control are often ineffective in achieving social, environmental or economic objectives. River system health is maintained through periodic large-scale flooding to 'flush' the system.

Pathways to enable the transition of the reserve system include the establishment of more cooperative models of government–landholder conservation partnerships, as an alternative to regulation, to improve conservation outcomes and increase landscape connectivity and buffer zones to support biodiversity. Vegetation retention would be encouraged through the expansion of appropriate carbon farming methods for landscape management. The tourist potential of the reserve system could be enhanced through statewide promotion and provision of affordable on-farm accommodation close to conservation areas. Data collection to support improved decision-making would be supported through long-term investment in monitoring, evaluation and reporting, and could be collected using novel technologies (such

as remote sensing and/or drones) to monitor landscape and species population changes. Opportunities under the NSW Government's *Saving our Species* program could be explored to protect threatened species on and off reserve.

A transformed reserve system will result in healthier landscapes that support and conserve regional biodiversity. Investments in the system allow for the improved knowledge of species population dynamics and foster the adaptive management of climate change impacts at a species, population and landscape level. The reserve system has increased in importance to the local communities through the integration of traditional owners in park management to complement scientific knowledge about sustainable land management. Viable, well-managed Aboriginal businesses such as bush foods are aligned to the objectives of the reserve system and increase local employment opportunities. Privatised reserves offset public costs and augment protection of natural and cultural values in the region.

3 How is the Far West vulnerable to climate change?

In partnership with regional decision-makers, the WERA process considers the climate vulnerability of regional communities in the context of biophysical impacts and socioeconomic change, with a focus on government service planning and delivery. By drawing on regionally specific data and local knowledge under the five capitals framework, an integrated understanding is developed of the relationships within key systems, and desirable adaptive responses and futures are identified.

3.1 Social and economic

People

The Far West region encompasses small communities separated by large distances.

The region's total population in 2011 was 43,618 and is distributed across small communities of between 2000 and 7000 people, with the exception of the Unincorporated Area, with a population of 698, and Broken Hill with 18,519 people (2011 Census), as shown in Figure 8.

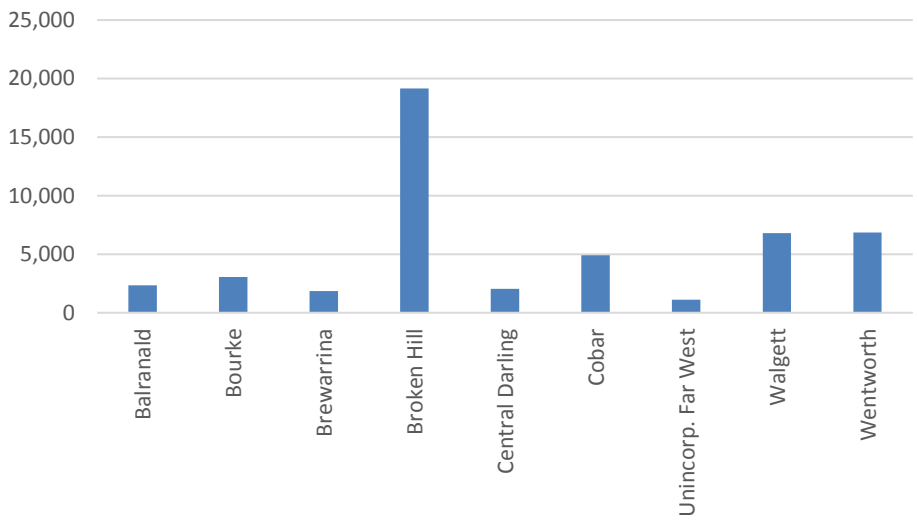

Figure 8: Local government area population statistics from 2011
Source: Department of Planning and Environment (2015)

The region consists of multiple Aboriginal language groups and incorporates all or part of 19 Local Aboriginal Land Councils. Based on 2011 Census data, the Indigenous population of the region is estimated to be around 7200 people or 16.5% of the total population (ABS 2013a).

Many areas in the region hold spiritual significance for Aboriginal people with over 12,462 cultural heritage sites and 11 Aboriginal Places identified under and protected by provisions of the *National Parks and Wildlife Act 1974*.

Brewarrina holds great historical significance to the Aboriginal people of the region as an inter-tribal meeting place. Mungo, within the Willandra Lakes World Heritage Area, is home to Aboriginal artefacts up to 50,000 years old. Mutawintji National Park, near Broken Hill, is home to 30,000-year-old rock carvings. Aboriginal fish traps on the Barwon River near Brewarrina are estimated to be 40,000 years old.

The population of the Far West region is projected to decline by 11% over the next 15 years (to 2031). The rate of change varies across the age profiles with the number of young people (less than 15 years old) declining by 16%, people of working age (15–64) also declining by 24%, and people 65 or older growing by 48%. This will see the proportion of people aged 65 years or older grow from 16% to 27% of the total population by 2031 (Department of Planning and Environment 2015).

The workforce participation rate for the region in 2011 was 57.4% (NSW 73%) and the working age population (i.e. those aged 15–64) of the region comprised 63.2% (NSW 66%) of the total population.

The region generally has both a younger and an older population compared to NSW, with a pronounced difference in the working age population (Figure 9). The region has higher dependency ratios than the state overall, meaning that a smaller proportion of its working age population is supporting a higher proportion of people deemed not to be in the workforce.

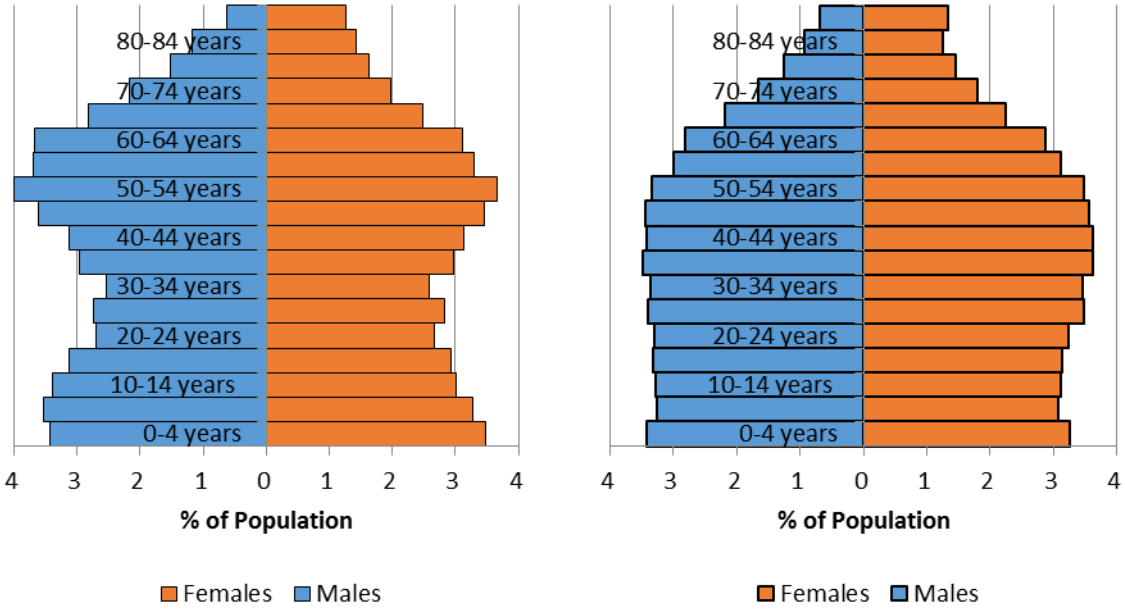

Figure 9: Age distribution in the Far West region (left) compared to NSW (right)
Source: Australian Bureau of Statistics (2013b)

Stakeholders from the region expressed the greater importance of social relationships and bonds, family links, groups, support networks and influences over political decisions. Some key points when assessing social capital for the region include:

- 84% of the region has a well-developed proficiency in English speaking compared to 13% not well or not at all among non-English speaking background people (ABS 2013a)
- 65% of the region is families, with the highest proportion of families classed as coupled families with no children (42%), followed by coupled families with children under 15 years (26%) (ABS 2013a)
- 20% of the population in 2011 was involved in volunteer activity (ABS 2013a)
- being able to contact family and friends not living in the same household can enhance a person's feelings of connectedness to the wider community and can build social resilience. Based on the 2014 General social survey (ABS 2015) most households have face-to-face contact with family or friends living outside of the household at least once a week or every day (Figure 10).

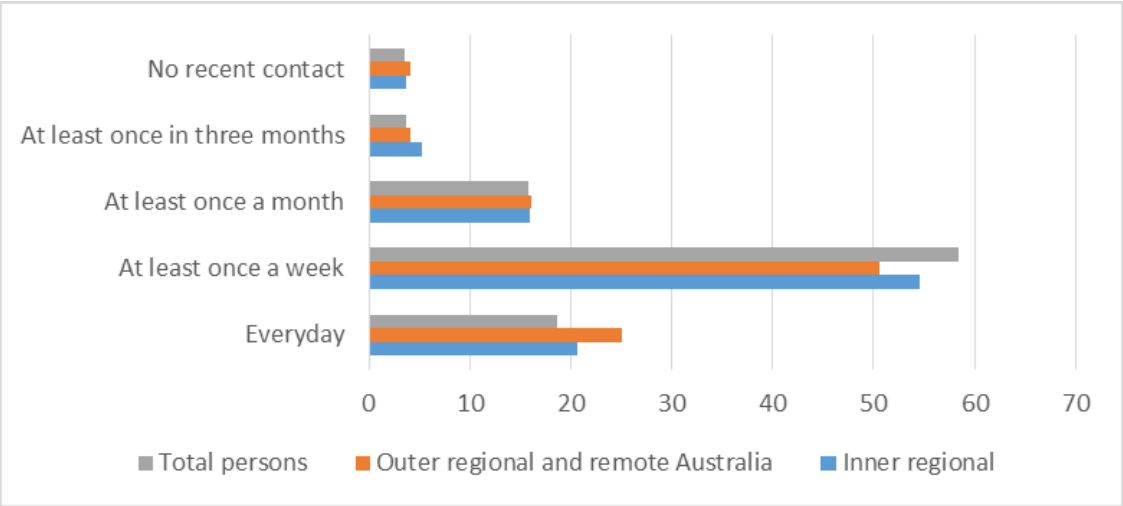

Figure 10: Frequency of face-to-face contact with family or friends living outside the household Source: Australian Bureau of Statistics (2015)

Human capital considers the skills, health and education of individuals that contribute to the productivity of labour and physical capability to respond to climate. Based on 2011 Census data key attributes of human capital for the region are:

- compared to the whole of NSW, people living in the region were much less likely to have completed Year 12 education and more likely to have left school before or directly after Year 10; people were less likely to have a post-secondary schooling qualification above certificate level (ABS 2013a)
- 92% of people living in the region spoke English at home compared with 2.9% who spoke another language (ABS 2013a)
- compared to the whole of NSW, the workforce had an under-representation of professionals and clerical workers and an over-representation of workers employed as labourers, managers and machinery operators (ABS 2013a)
- the incidence of obesity is higher than NSW; the incidence of psychological distress is also high in the Far West compared to the whole of NSW (Centre for Epidemiology & Evidence n.d.)
- four local government areas were ranked in the top 20 for socioeconomic disadvantage based on the ABS Socio-Economic Indexes for Areas (SEIFA; ABS 2013b)
- communities generally experience difficulties accessing health services (ABS 2015).

Economy

In 2013, the region contributed $2.9 billion to Gross Regional Product (GRP) and supported 17,109 local jobs (Department of Industry 2015). Industry is varied, with the major employment sectors being agriculture, forestry and fishing, health care and social assistance, mining, retail trade, education and training, and accommodation and food services.

Agriculture contributed around $338 million in 2013 and is a strong sector of the economy and top employer for the region (Department of Industry 2015). In recent years, agriculture has expanded beyond traditional wool production, into cotton, malted grains, grapes and stone fruits, as well as goat and meat sheep production. However irrigated lands are sensitive to the availability of water and the implementation of the Murray–Darling Basin Plan, and further affected by droughts and floods.

Mining is a key driver of the region's economy, with the sector making the largest contribution to GRP in 2013 at $733 million (Department of Industry 2015). It is only the third largest employer (around 9%) however, apart for in Cobar where almost one in three workers were employed in this sector.

The health care sector is also a large employer reflecting the increasing demand for services in the region, being the top employer for Broken Hill employing 17% of the workforce.

Retail trade and education and training complete the top five employers for the Far West.

The region has also seen strong growth in publishing and creating and performing arts activities from a very small base.

Table 1: Top five industries by contribution to GRP and top five employers by industry

Industries by contribution to GRP in 2013	Employers by industry in 2011
1. Mining (25.6%)	1. Agriculture, Forestry and Fishing (15.7%)
2. Agriculture, Forestry and Fishing (11.8%)	2. Health Care and Social Assistance (12.5%)
3. Health Care and Social Assistance (6.5%)	3. Mining (9.4%)
4. Public Administration and Safety (6.0%)	4. Retail Trade (9.3%)
5. Education and Training (5.1%)	5. Education and Training (9.0%)

Source: Department of Industry 2015

Physical capital comprises the items produced by economic activity from other types of capital such as the built environment, infrastructure and equipment (houses, schools, clinics, roads, farm machinery, producer goods accessible by community). Based on 2011 Census data key attributes of physical capital for the region are:

- Separate occupied houses (73.3%) are the dominant dwelling type, followed by unoccupied dwellings (19.8%). A small percentage are flats or units (3.6%), or caravans, cabins or houseboats (1.6%) (ABS 2013a).
- Broadband is the most available internet connection type (53%); however at 34%, absence of internet access was high (NSW 20%) (ABS 2013a).
- There are a total of five private schools, 42 public schools, eight hospitals and 12 libraries (Education NSW 2016; Health NSW 2016; Private Schools Directory 2016).

3.2 Biophysical

With a semi-arid climate across much of the region, the Far West is home to a natural landscape that supports a high diversity of species and ecosystems. Much of the area falls within the Murray–Darling Basin, dominated by wide floodplains and tributaries into the Darling River. The main river systems are the Bulloo Overflow, Paroo, Darling, Murray and Murrumbidgee.

The region has a large reserve system, covering over 1.2 million hectares, including six major national parks: Sturt, Gundabooka, Mutawintji, Paroo-Darling, Kinchega and Mungo. It is also home to the Willandra Lakes World Heritage Area and Ramsar-listed wetlands including Narran Lake Nature Reserve, Paroo River Wetlands and Lake Pinaroo.

The Far West region is influenced by its low-lying topography and distance from the coast. The eastern fringe experiences the highest rainfall totals in the region, whilst the central and western parts are very dry. It is hot in the north of the region during summer, with cool winters in the southern and central areas. Milder conditions are found along the southern fringe adjacent to the Victorian border, with cooler summers than the rest of the region.

The vegetation and landscape of this region have been substantially modified through the expansion of pastoralism and artificial water sources derived from the Great Artesian Basin, and impacts of feral animals, in particular goats.

3.3 Expected regional climate change

Information on projected climate for the region can be found in the Far West Climate Change Snapshot report on the AdaptNSW website (OEH 2014). The snapshot provides near future (2030) and far future (2070) scenarios (see Table 2 below).

The climate projections for 2020–2039 are described in the snapshots as *near future*, or as 2030, the latter representing the average for the 20-year period. The climate projections for 2060–2079 are described in the snapshots as *far future*, or as 2070, the latter representing the average of the 20-year period.

In summary:

- The Far West region is expected to experience an increase in all temperature variables (average, maximum and minimum), more hot days, and fewer cold nights for the near and far futures. Heatwaves are also projected to increase, be hotter and last longer.
- Seasonality of rainfall will change. Autumn and summer rainfall will increase in the near future and the far future. The majority of models agree that winter rainfall will decrease in the near future. Spring and winter rainfall is projected to decrease in the near future; however, the changes are less clear for winter rainfall in the far future.
- Fire risk will increase, with projected increases in average and severe fire weather in the near future and the far future.

Table 2: Climate change projections for the Far West region

Climate variable (average across the region)	Trend	Projections	
		Near future (2030)	Far future (2070)
Atmospheric CO_2	Increase	High (current) global emission scenario	
Max. temperature	Increase	<0.5 – 1.5°C	1 – 3°C
Min. temperature	Increase	<0.5 – 1.5°C	1 – 3°C
Hot days	Increase	10 – 20 days	20 – >40 days
Cold nights	Decrease	0 – 5 days	10 – 20 days
Heatwaves	Increase (frequency) Increase (intensity) Increase (duration)	1 – 1.5 events 1.5 – 4.5°C 1.4 – 3.5 days	2.5 – 4.5 events 4.5°C 7–9 days
Annual rainfall*	Drying & wetting	–13% to +11%	–10 to +22%
Seasonality rainfall (change in average rainfall)*	Drying & wetting	Summer –10% to +20% Autumn 0% to +30% Winter 0% to –20% Spring 0% to –20%	Summer +5% to +30% Autumn +5% to +30% Winter –10% to +20% Spring –20% to +10%

*Negative values represent drying and positive values represent wetting under projections for annual rainfall and seasonality rainfall. Source: Office of Environment and Heritage (2014)

Climate change will impact agricultural systems (affecting crops, evaporation of surface water and stock), vulnerable groups within regional communities (such as the ill, very young and the elderly), natural ecosystems, regional infrastructure and fire management (see Appendix A).

3.4 Vulnerability affecting government services

Local decision-makers identified eight factors that affect the vulnerability of the Far West region, which interact to set constraints and opportunities around the ability of government to service the community. Already influencing the region, the importance of these vulnerabilities is likely to be amplified by changes to climate:

1. **Culture**: personal self-reliance is a community strength but can become insular with an inability to accept assistance.
2. **Leadership**: supports strategic visions, planning and governance.
3. **Connectivity**: strong social networks maintain regional cohesion and identity, and are enabled by modern technology.
4. **Skilled workforce**: regional skills need to be well-aligned with the requirements of adaptation to climate, changes in the job market and adoption of technical innovations.
5. **Health and social equity**: equity of access to services is critical to maintain remote community health.
6. **Natural resource dependency/security**: secure access to the supply of natural resources underpins regional prosperity.
7. **Government dependency**: reliance on government funding and public sector employment limits economic diversity.
8. **Appropriate infrastructure**: investment in efficient, appropriate and adapted infrastructure supports community transformation.

Vulnerability

Regions in NSW vary in their vulnerability to climate change. Figure 11 shows a snapshot of vulnerability for the Far West. The snapshot draws on workshop activities, the adaptation survey, discussions and supporting literature and data to illustrate regional vulnerability as having three components:

- **red boxes**: exposure to the range of biophysical and socioeconomic drivers that could potentially stress the ability of the region to function
- **orange boxes**: sensitivity to the diverse impacts that result from exposure to drivers of change
- **green box**: adaptive capacity, which is the set of attributes that act to determine how the region might respond to reduce future vulnerability. If present, these attributes can enable adaptation. If these attributes are absent or negative, then adaptive responses will be constrained, and the region will remain vulnerable.

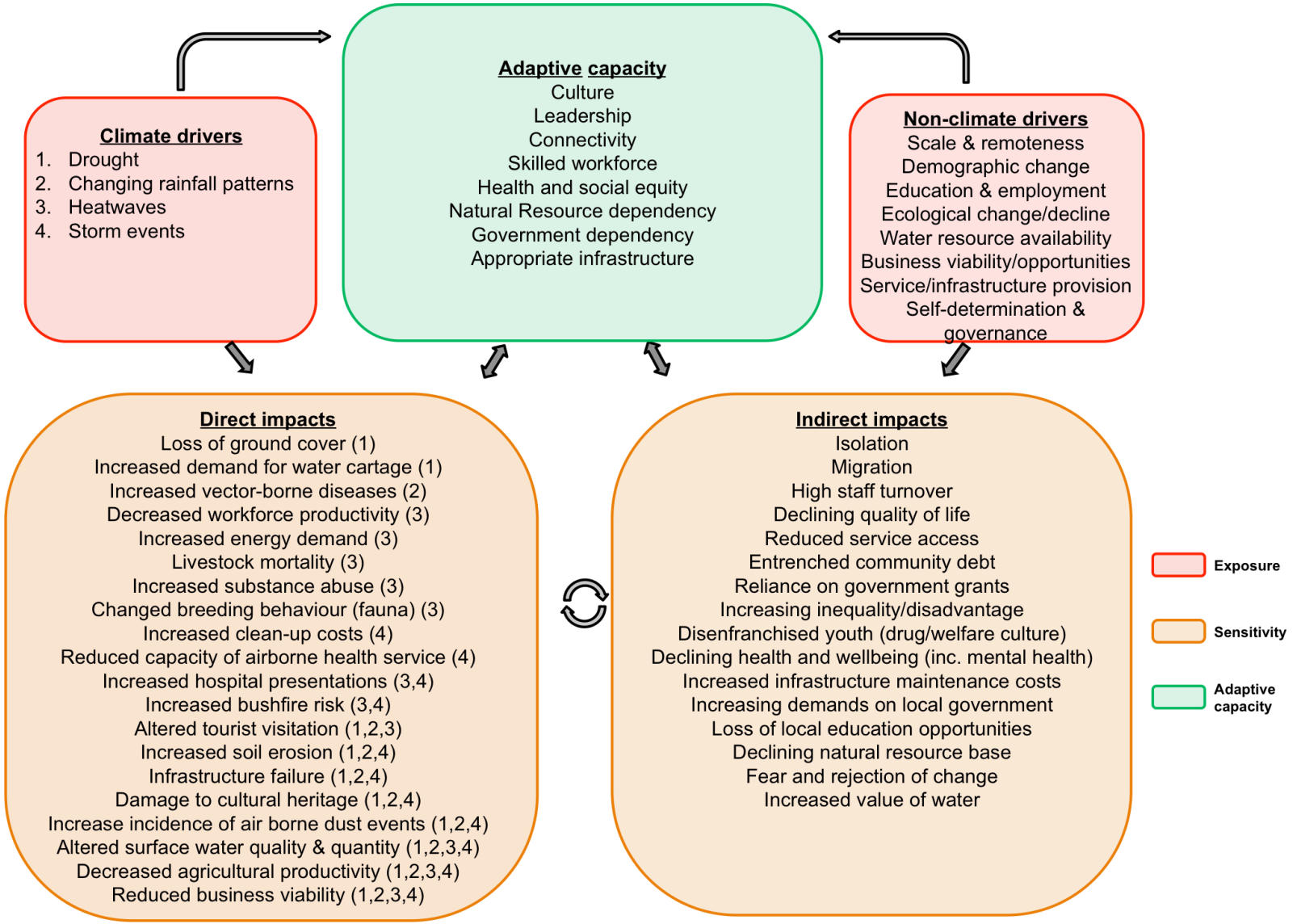

Figure 11: Snapshot of vulnerability in the Far West region Numbers in brackets under direct impacts link the impact to the climate driver(s)

Exposure

Climate drivers

Four main climate drivers for the Far West were identified through the survey and workshops: drought, heatwaves, changing rainfall patterns (amount, seasonality and effectiveness), and more intense storm events. Of these drivers, changes to rainfall and heatwaves are projected in the regional climate modelling mentioned in Section 3.3 above and on the AdaptNSW website (OEH 2014).

Non-climate drivers

Non-climate drivers are drawn from the system transition models representing the range of socioeconomic and biophysical changes currently affecting the region. They operate at a range of scales from state (demographic change), to regional (water resource availability) and local (ecological change, self-determination and governance). Of importance to the region was the influence of scale and remoteness, which underlies population change, affects community access to goods and services and education and employment opportunities. The arid climate of the region places reliance on infrastructure to transport water over vast distances in addition to inter-region governance arrangements that influence water resource availability (such as the Murray–Darling Basin Plan). The education driver helps to build the skills and knowledge necessary for individuals to find and retain meaningful employment, which in turn influences the viability of local businesses and diversification of the local economy.

Sensitivity

Direct impacts

The impact of climate change in the Far West region manifests through the effects of extreme events. These direct impacts, shown in Figure 11, summarise the initial interconnected impacts that ripple through the region's systems (see also the impact chain diagram in Figure 16). For example, the direct impacts of drought result in a loss of groundcover, which accelerates erosion and increases the incidence of airborne dust events. Heatwaves cause diverse impacts such as increased energy demand, decreased workforce productivity, increased substance abuse and increased livestock mortality.

Multiple impacts from individual climate drivers often converge at critical points of intersection. For example, impacts from heatwaves and storm events converge to increase hospital presentations and heighten the risk of bushfires. Impacts of drought, changing rainfall patterns and heatwaves converge to alter tourist visitation, which has flow-on effects to local businesses and employment. All four climate drivers intersect to alter surface water quality and quantity and reduce agricultural productivity and business viability.

Indirect impacts

These are the concluding impacts, which have 'snowballed' along the impact chains shown in Figure 16. They represent further socioeconomic and biophysical drivers of change that affect the region, culminating from climate drivers, and are heavily influenced by non-climate drivers in complex ways. For example, a lack of infrastructure in the form of reliable internet can result in a loss of local education opportunities, which may exacerbate social inequality and disadvantage, further disenfranchise youth and impact community health and wellbeing. The geographical remoteness of the region contributes to isolation, reduced access to services and, in combination with the impacts of climate change, declining quality of life. High replacement and maintenance costs for infrastructure damage by extreme climate events places greater demands on local government resources and limits service delivery.

Adaptive capacity

The attributes listed under adaptive capacity are largely aspirational. They represent a set of available resources, or changes to resource use, that provide options to act to reduce regional vulnerability to climate change in the face of future uncertainty. For example, the harsh conditions of remote NSW foster a culture of stoicism and self-reliance. Under climate change such traits will be important, provided Far West communities also encourage acceptance and tolerance of 'outsiders'.

Strong leadership to tackle the threats posed by climate change can facilitate adaptation action. Secure access to natural resources, especially water, supports healthy communities and a diverse economy. A skilled workforce underpinned by appropriate regional infrastructure contributes to the regional economy and meaningful employment in the region. Dependency on government as a source of funding and employment limits regional economic diversity and limits regional governance and self-determination. The transition pathways identified in the change models for the key regional systems (Chapter 2) and the 'first steps' projects outlined in Chapter 5 provide a mechanism to achieve regional aspirations for adaptive capacity.

While sectors of the regional economy may prioritise differently the various aspects of vulnerability that affect their service delivery, there is considerable overlap among them. Table 3 lists the sectoral priorities for the direct and indirect impacts and adaptive capacity indicators.

Table 3: Sectoral priorities for direct and indirect climate impacts and adaptive capacity

Sector	Direct climate impacts	Indirect climate impacts	Adaptive capacity
Economy and industry	• Infrastructure failure • Decreased agricultural productivity • Reduced business viability • Loss of groundcover	• Increasing inequality and disadvantage • Declining natural resource base • Declining quality of life	• Leadership • Skilled workforce
Human services	• Infrastructure failure • Decreased agricultural productivity • Reduced business viability • Loss of groundcover	• Loss of local education opportunities • Declining quality of life • Increasing inequality and disadvantage	• Leadership • Connectivity
Settlements and infrastructure	• Infrastructure failure	• Reliance on government grants	• Leadership • Culture • Government dependency
Natural resources and ecosystems	• Decreased agricultural productivity • Altered surface water quality and quantity • Increased soil erosion	• Increasing inequality and disadvantage • Migration	• Natural resource dependency and security
Emergency management	• Infrastructure failure • Increased vector-borne diseases • Increased clean-up costs	• Reliance on government grants • Increasing demands on local government	• Skilled workforce • Leadership • Appropriate infrastructure • Government dependency

4 How do we know?

4.1 Description of the ERA process

The Enabling Regional Adaptation (ERA) process has been designed to develop a shared understanding among stakeholders of the likely vulnerability to climate change, and stimulate action to plan adaptation. To undertake the assessment, ERA engages state and local government participants from different sectors to ensure cross-sectoral and cross-scale operational knowledge and constraints are considered.

Sector	Scope
Emergency management	Emergency management (fire, flood, heat, bushfire), infrastructure and utilities, public health / disaster management
Human services	Education, health, senior, youth and child services, meals on wheels, library services, disability services, community services, health and education asset management and planning
Economy and industry	Business development, tourism, legal, professional services
Landscapes and ecosystems	Natural resource management, biodiversity, conservation, Aboriginal and historic heritage
Settlements and infrastructure	Regional and local strategic planning, local development, buildings and settlements, transport (rail, road, freight, buses) water (stormwater, sewer, water), energy, telecommunications, community infrastructure

Due to the complexity inherent in analysing adaptation at a regional scale, the approach uses both qualitative and quantitative techniques to integrate multiple lines of evidence gathered through subregional workshops, participant surveys, and shift-share analysis to identify locally competitive industries derived from ABS Census data.

ERA engages participants in cross-sectoral workshops where they are provided with regional climate projections, socioeconomic data and regional knowledge. Through a series of hands-on activities participants determine impact chains, adaptive capacity and key regional systems. Final outputs of this process provide a description of regional climate vulnerabilities, system transition models and projects to activate pathways (Figure 12). An online survey was also undertaken before and after the workshops (see Chapter 6).

ERA has been carried out in such a way that it incorporates:

- a system thinking approach that acknowledges communities exist within human–natural (or social–ecological) systems
- participatory engagement in which stakeholders co-create an understanding of vulnerability through their deep understanding of the region
- a focus on developing an understanding of the constraints to adaptation, and on identifying opportunities for building adaptive capacity so communities can deal better with climate shocks regardless of their nature or timing
- qualitative analysis supported wherever possible with quantitative data, which acknowledges that societal interactions are complex and contradictory in nature, and not amenable to expert-led, reductionist approaches to problem analysis.

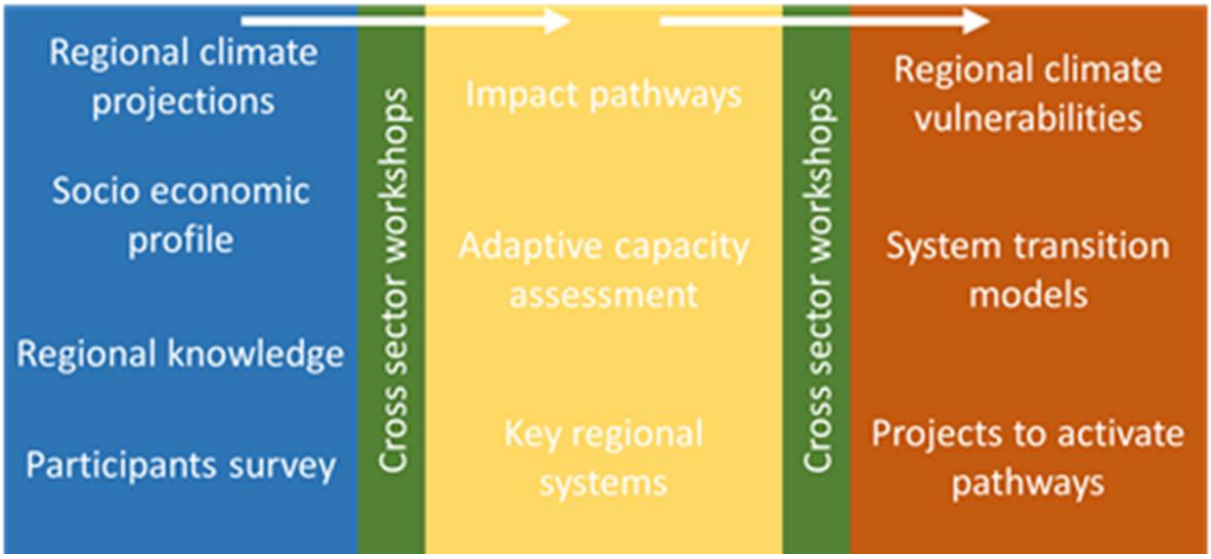

Figure 12: Enabling Regional Adaptation process

4.2 Far West regional workshops

In early 2016, OEH and the Institute for Sustainable Futures led a series of workshops in the Far West region as part of an ERA process for Western NSW (the WERA project). The workshops used participatory learning techniques to discuss, explore and gather information and data on the impact of climate change on regional systems and opportunities to respond. The workshops were held in two stages: the subregional workshops focused on identifying regional climate vulnerabilities and the integration workshop focused on developing regional change models.

Two subregional workshops were held in mid-March 2016 in Broken Hill and Dubbo. The workshops facilitated a consultation with 35 representatives of NSW Government agencies, local government and key regional stakeholders, including:

- Bourke Shire Council
- Broken Hill City Council
- Central Darling Shire Council
- Cobar Shire Council
- Crown Lands
- Department of Education and Training
- Department of Family and Community Services
- Department of Premier and Cabinet
- Department of Primary Industries
- Local Land Services
- National Parks and Wildlife Service
- NSW Ambulance
- NSW Health
- NSW Police Force
- Office of Environment Heritage
- Orana Regional Organisation of Councils
- TAFE NSW
- Wentworth Shire Council

Workshops aimed to:

- present the latest climate projections for the Far West region
- present background socioeconomic analysis to inform workshop discussions of system changes
- conduct an Integrated Regional Vulnerability Assessment (IRVA) to understand the climate impacts for the region and assess adaptive capacity to respond
- identify regional systems that needed to change to reduce vulnerability to climate change.

The integration workshop was held in June 2016 in Broken Hill with 14 participants to:

- construct a climate impact timeline to encourage consideration of climate projections in light of extreme climate events, regional socioeconomic trends and policy processes (Figure 13)
- develop qualitative, system change models that identify transition pathways leading to a transformed future
- prioritise regional adaptation actions (through discrete projects) to promote transition and limit maladaptation
- continue to build the regional capacity to deliver best practice adaptation.

Throughout the workshops tacit local knowledge held by the participants was used to guide our understanding of the current vulnerability of government service delivery in the region, and to identify and capture opportunities to build regional resilience.

Figure 13: Climate impact timeline for the Far West region

4.3 Impact chains

Understanding how climate variability and extreme events will affect the region is a vital first step towards planning and implementing adaptation responses. Drawing on the regional climate projections and socioeconomic information, participants constructed impact diagrams to illustrate impact chains and influence relationships stemming from each of the major climate drivers. A section of the diagram showing the detail of impacts related to drought is shown in Figure 14. The entire diagram illustrating the complexity of effects from the four main climate drivers is shown in Figure 16. These diagrams allowed two types of impacts to be identified along impact chains: direct impacts were those that were directly attributable to climate change and appear on impact chains near climate variables; indirect impacts resulted from the flow-on effects of climate variables and were also influenced by external regional drivers. Indirect impacts appear further along the impact chains.

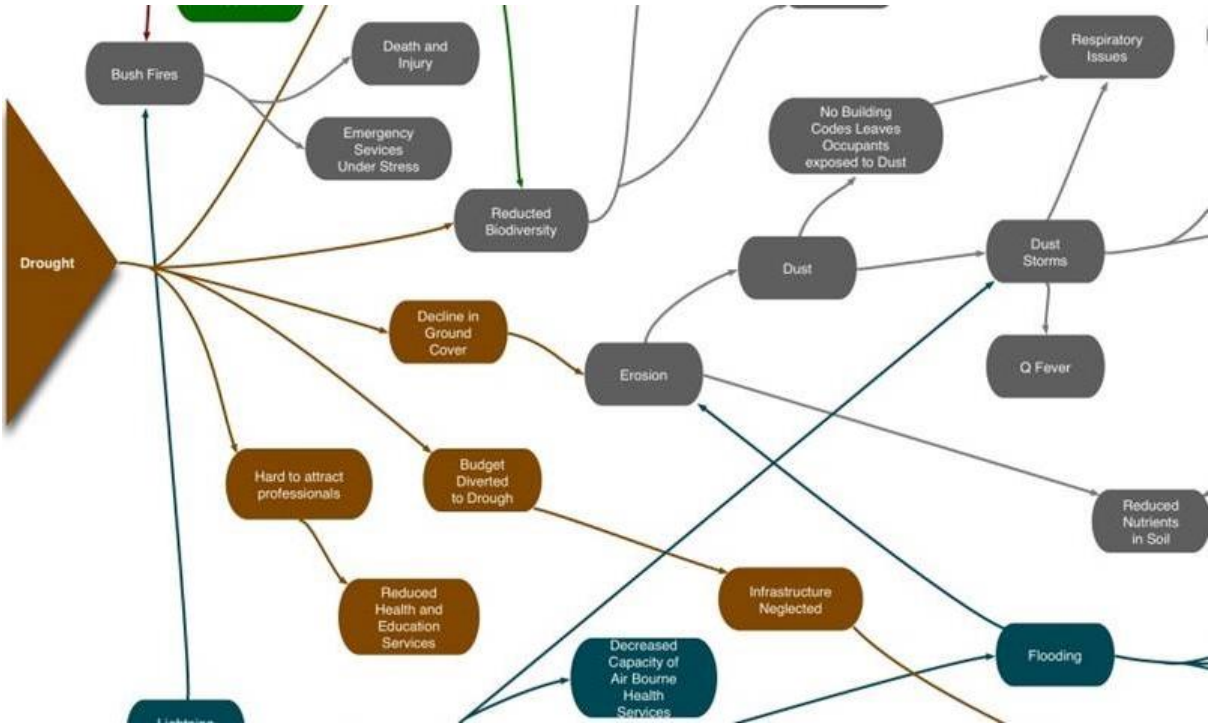

Figure 14: Section of the Far West climate impact diagram showing the impact of droughts

4.4 Key regional systems

Each subregional workshop identified the regional systems considered most in need of transformation to adapt to climate change. Four key systems were identified in the Dubbo workshop and three in the Broken Hill workshop (Figure 15). These seven systems were refined in the integration workshops to reduce redundancy and focus specifically on systems that could be influenced through action at a regional scale. The models are not intended to represent all aspects of the region; rather they reflect the expertise of workshop participants and provide a mosaic of the major systems of the Far West region.

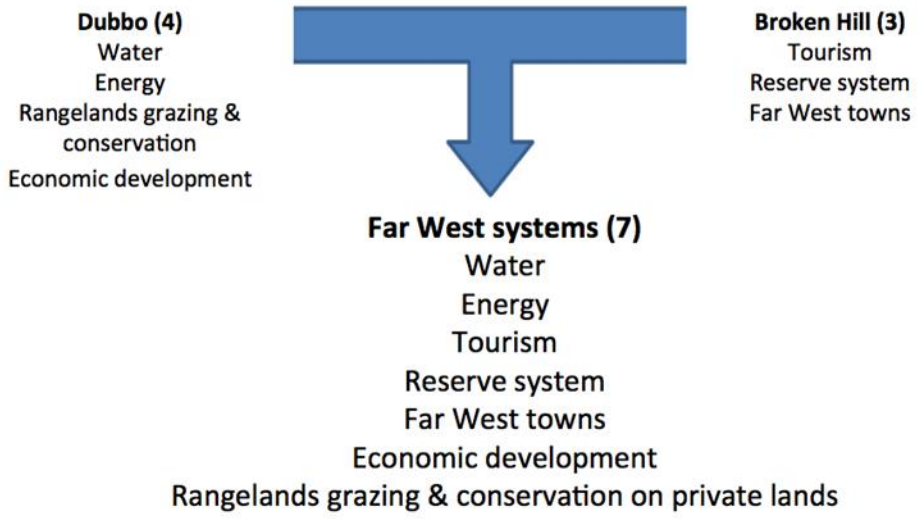

Figure 15: The key regional systems identified for the Far West region

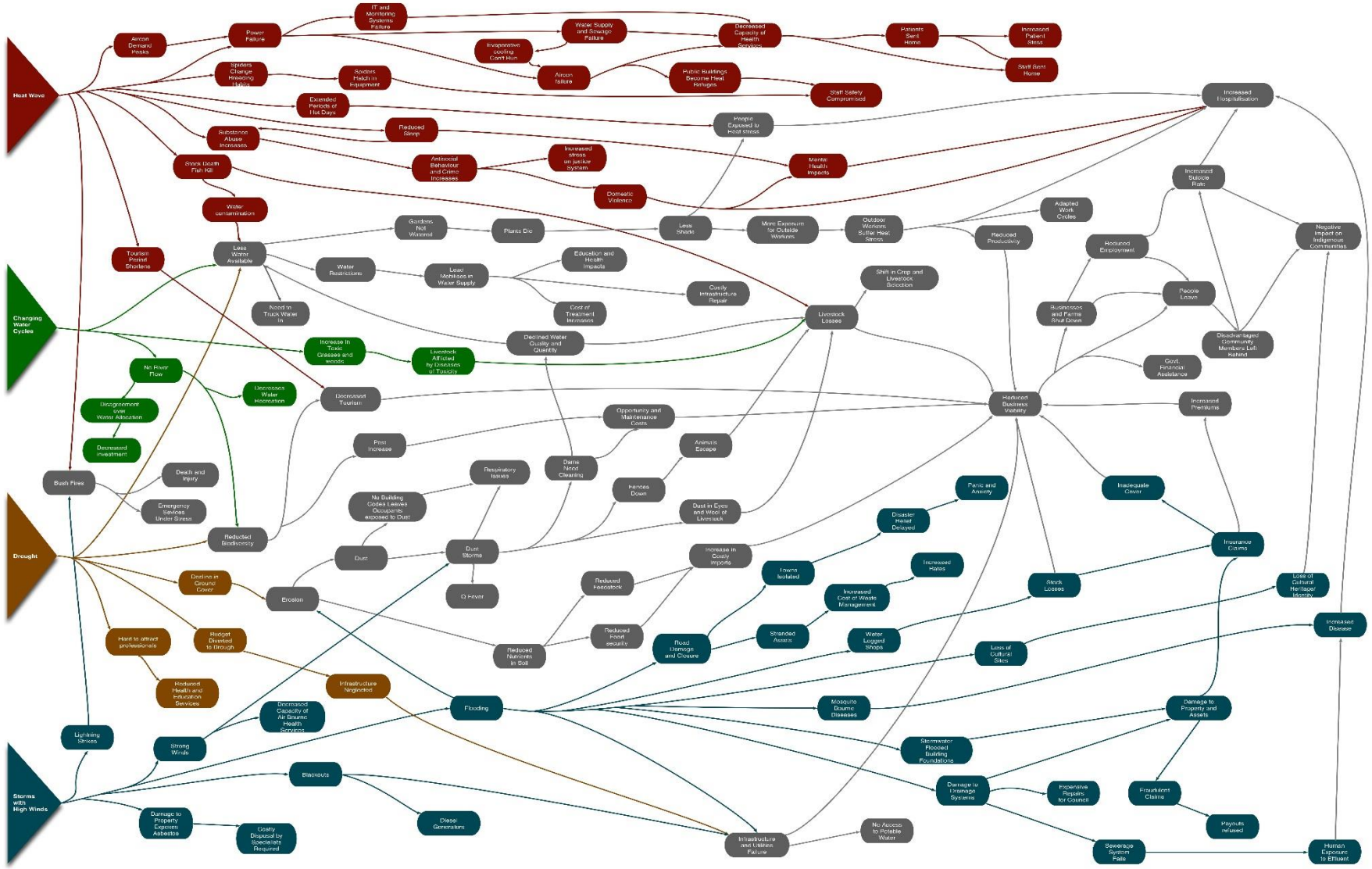

Figure 16: Climate impact chains for the Far West region

4.5 System change models

Thinking of adaptation as a series of strategic pathways to transition away from business-as-usual was an effective technique to engage workshop participants in a discussion of system transformation in the region. The approach envisions transformational change toward a desirable future as a series of transition pathways that emerge from current practice either through existing innovations or because of new drivers of change (Figure 17).

For each of the key systems the workshop participants discussed:

- business-as-usual (BAU) – what constitutes BAU in their service delivery area and what changes or 'tweaks' are being made to ensure resilience of the current system
- system drivers – the relative strengths of multiple drivers determine the extent and direction of change within the system. Drivers of change lead to the emergence of 'pockets' of innovation that offer transition pathways to a 'planned' transformation
- transition pathways – any new practices/changes/trends that may serve as an alternative to BAU that are emerging now or in the near future. These pathways could emerge from changes in the economy, society, the environment, technological development or politics
- barriers and enablers – for selected transition pathways participants identified the barriers to and enablers of change, who they need to work with, and any aligned processes or policies
- transformed system – participants were asked to identify their vision of service delivery in 2050 and articulate what the features of the transformed system would be.

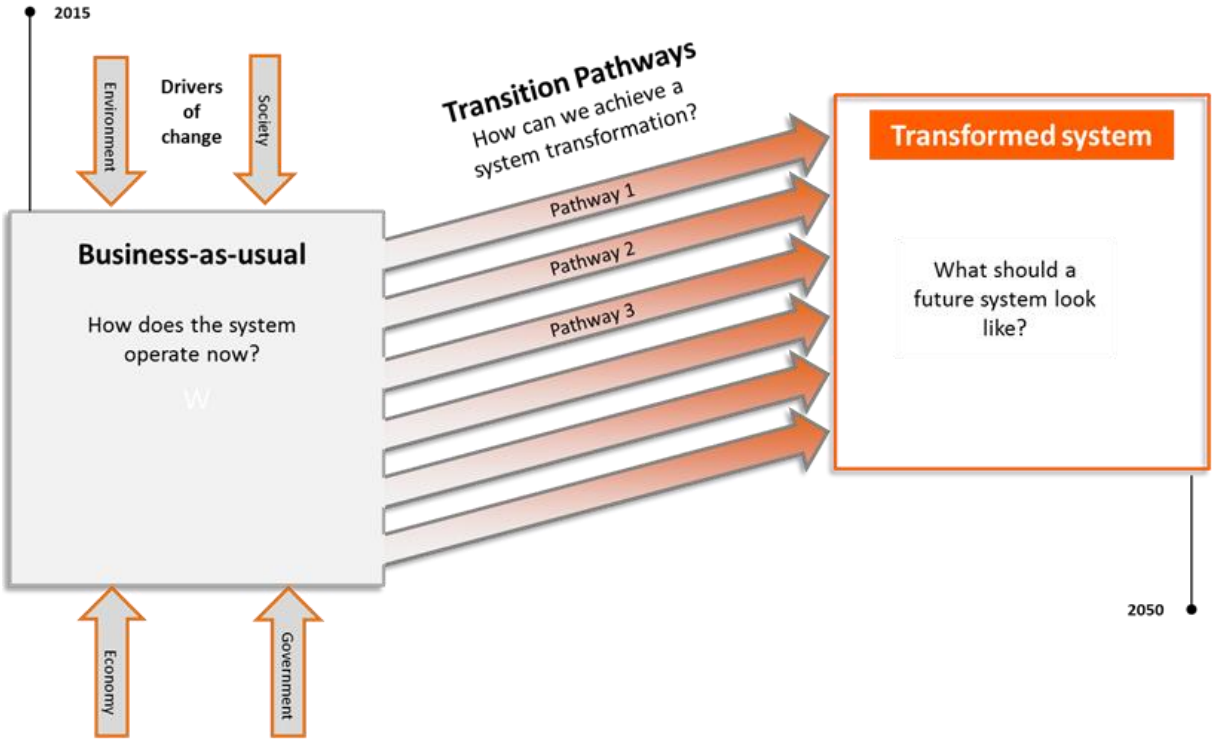

Figure 17: Conceptual model of transformative change Source: adapted from Jacobs et al. (2016)

5 What can we do about it?

5.1 Projects to activate pathways

Workshop participants voted on the various pathways for each of the seven regional systems to determine the key priorities for government from the range of transition pathways. The participants then worked together in cross-sectoral groups to identify transition projects to progress toward regional transformations to address climate vulnerabilities. Descriptions of these projects are outlined in Table 4.

Table 4: Pilot projects to activate pathways

Pilot project	Description	System
Far West tourism roundtable	Convene key stakeholders to form a roundtable to build a vison and deliver a coordinated approach to tourism in Broken Hill and surrounding areas to drive sustained growth in the visitor economy	Tourism
Broken Hill airport expansion	Undertake a cost–benefit analysis, to inform a prospectus for extending the runway at Broken Hill airport to accommodate larger aeroplanes and grow capacity for a wider range of services	Tourism
Regional clean energy strategy	Develop a regional strategy to grow opportunities for investment in small and large-scale sustainable clean energy generation, so that the region can export excess energy into South Australia and Victoria	Energy
Conserving private lands neighbouring national parks	Map and market private land conservation incentives and opportunities around national park buffers to support and increase the adaptive capacity of landscapes and ecosystems impacted by climate change	Far West reserve system
Enterprise-based conservation on private lands	Grow opportunities for private land conservation through valuing ecosystem services and incentivising conservation land use through carbon farming or other programs with stewardship outcomes	Rangeland grazing and conservation
Employee marketing to attract and retain regional skills	Attract skilled workers (short-term: backpackers, volunteer tourism and longer-term: skilled migrants/refugees) by target marketing Far West benefits to attract investment and employees, and arrest population decline	Far West towns
Strategic Framework for Priority Infrastructure Investment	Undertake an analysis of what is required to sustain a town in the Far West and use this to develop a framework to guide infrastructure planning decisions and investment, to strengthen the region	Far West towns
Far West communication platform	Create an online space where regional colleagues can share information, ideas and data to build personal and professional knowledge, expertise and relationships (e.g. Yammer)	Far West towns
Water sensitive city ‘Living Lab’	Establish a collaborative research project to baseline current water use and efficiency in a Far West town, to allow for better costs and benefits analyses, to inform effective water allocations and development of innovation infrastructure and behavioural solutions	Water

5.2 Actions underway

Since the inception of the WERA project in the Far West, several actions to enhance regional adaptation planning have commenced including:

- inclusion of references to the WERA process in the Department of Planning and Environment Far West Regional Plan
- Cobar Shire Council being awarded a grant from the Building Resilience to Climate Change program for the development of a Cobar Airport Climate Resilient Master Plan to ensure the airport facilities can meet operational requirements to withstand climate change stresses, by ensuring an all-weather, durable airstrip in the region
- Bourke and District Children's Services being awarded a grant from the Community Resilience Innovation Program to build the disaster preparedness of Bourke Children's services in remote NSW
- awarding of a regional scholarship for a Far West ERA participant to attend the Learning to Adapt professional development program delivered by the Environment Institute of Australia and New Zealand and supported by OEH.

5.3 Supporting processes

Climate Change Fund

In November 2016, the NSW Government announced an Environmental Future Funding package, which includes a Climate Change Policy Framework outlining the Government's ongoing commitment to action on climate change. It also included a Draft Climate Change Fund Strategic Plan, with priority investment areas and potential actions for up to $500 million of new funding over the next five years from the Climate Change Fund. The draft strategic plan proposes three priority investment areas that will form the basis of future action plans for:

- accelerating advanced energy
- national leadership in energy efficiency
- preparing for a changing climate.

Building Resilience to Climate Change program

The Building Resilience to Climate Change (BRCC) program is a partnership between Local Government NSW and OEH to address identified climate change risks and vulnerabilities facing NSW councils.

The program was established to encourage:

- enhanced consideration of climate change impacts in local and regional decision-making
- delivery of projects that minimise climate change impacts for local and regional decision-makers
- implementation of climate change adaptation beyond current projects and programs
- fostering of adaptive capacity in local government through a community of practitioners across professional disciplines with direct experience in implementing adaptation responses across NSW.

Community Resilience Innovation Program

The Community Resilience Innovation Program (CRIP) supports a broad range of community-led projects designed to increase all-hazard disaster preparedness and build community capacity and resilience. CRIP projects are based on collaboration and partnership between local community organisations and emergency services agencies. CRIP aims to:

- encourage local communities to engage in creative, community-focused activities that will enhance disaster resilience
- develop effective partnerships and build networks between local community organisations, councils, businesses and emergency services agencies
- foster ways to effectively engage the local community in emergency management and resilience building
- share knowledge and lessons learnt about new approaches and models through project evaluation
- support initiatives that can be integrated into current business and maintained in the longer term.

CRIP is a scheme under the Natural Disaster Resilience Program, funded by the NSW and Commonwealth governments through the *National Partnership Agreement on Natural Disaster Resilience*.

6 Measuring progress

6.1 Adaptation process

The ability to detect change is a critical component of any monitoring program because it facilitates adaptive management (Allan & Curtis 2005); however, issues associated with monitoring and evaluating climate adaptation are well-documented and include (Bours et al. 2013):

- measuring adaptation against a moving climate baseline
- consideration of avoided impacts through counterfactual arguments that are difficult to prove, such as 'if we hadn't undertaken this adaptation action the outcomes might have been much worse'
- the difficulty with attempting to attribute an adaptation outcome to a course of action, as often multiple actions have contributed to improved climate resilience
- local adaptation actions can have outcomes that span multiple scales, sectors and responses
- the lack of a universal set of indicators against which adaptation can be measured.

Despite these difficulties, organisations (private and public) are moving from *awareness* about the need to manage climate change risks to *implementing actions* to manage them. This has led to the emergence of a common set of practices considered necessary to deliver effective adaptation to climate change: the adaptation process cycle (Figure 18). All the processes in the cycle commonly occur as part of action to adapt to climate change in NSW.

A well-defined process cycle is central to effective benchmarking. Benchmarking can be used to evaluate an organisation, business or process against external criteria. The objectives of benchmarking are to determine what and where improvements may be made, to analyse the ways in which other groups achieve high performance, and to use this information to drive improvements in performance. Benchmarking represents a 'soft policy' that encourages flexible planning, local consultation and incorporation of local context coupled with institutional support at higher scales of governance. Soft policy instruments can create a 'stickiness' that works towards achieving desirable outcomes that are embedded and accepted in everyday practices.

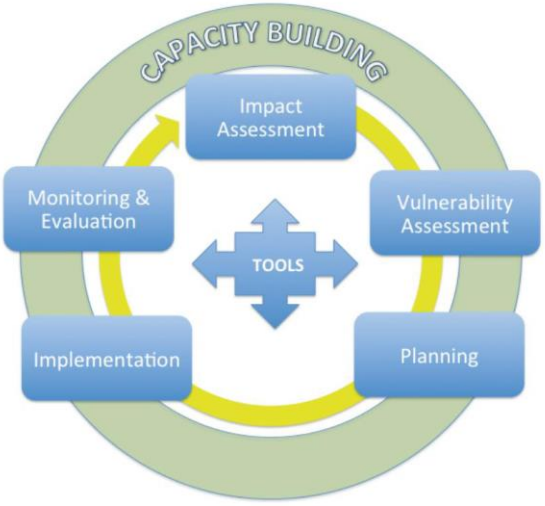

Figure 18: The adaptation process cycle Source: Hansen et al. (2013)

For climate change, benchmarking the adaptation process at the regional scale circumvents many of the problems with attempting to assess and aggregate local-scale adaptation actions. The WERA process focuses on assessing the degree to which organisations are employing an effective adaptation process rather than the effectiveness of government adaptation processes or interventions; the underlying assumption being that good process leads to good adaptation decisions. This type of approach was used by Hansen et al. (2013) in a national climate adaptation benchmarking exercise conducted across several sectors in the USA.

6.2 Adaptive capacity

One way to promote adaptation action is to build regional capacity to adapt (Jacobs et al. 2015). Targeted capacity building requires an understanding of where the barriers to action lie in the region, which is generally related to the resources available for adaptation and the ability to use them. These resources commonly include awareness, knowledge and skills, and staff resources (human capital), engagement and networking with the community and other organisations (social capital), the formulation of strategic plans, and the financial resources to implement adaptation actions. Monitoring adaptive capacity over time can provide an additional measure of regional change.

6.3 Regional online survey

A qualitative survey was conducted to benchmark regional adaptation actions at the start of the project, to provide a baseline, and following completion of the WERA workshop process, as a preliminary assessment of change. The survey was available online for a period of six weeks between February and April 2016 (initial) and again in April 2017 for three weeks (post-workshops).

The response rate varied considerably between the two survey times. The results presented here will focus on the initial survey because the response rate was higher, and therefore, is likely to represent regional conditions more reliably. The change in response rate means that small differences in results between sampling times are difficult to attribute to any single factor. They may be the result of an altered sampling frame (for example, differences in representation across tiers of government or a change in the mix of agencies that responded to the survey) or to real differences in regional conditions. Despite this we will present differences between the two surveys in response to selected questions, particularly where they relate to identification of new, local adaptation projects.

In total, 42 people from across all levels of government responded to the survey. The majority (81%) of respondents represented NSW Government agencies, with just under 10% from local government and regional agencies. About 10% of survey respondents identified as being of Aboriginal or Torres Strait Islander heritage.

In total, 30 respondents completed the follow-up survey. The representation of respondents was spread across NSW Government agencies (67%), local government (23%) and regional organisations (7%). One respondent represented a non-government organisation. One respondent identified as being of Aboriginal heritage. Just over half (67%) of respondents had attended at least one of the OEH ERA workshops in 2016.

Perceived key climate change risks

In both surveys the respondents identified several climate related risks facing the Far West. Drought, heatwaves, changing rainfall patterns and intense storms with high winds were identified as the top four critical climate risks facing the region (Figure 19). Increased hail events and frost were perceived as the least important climate related risk in the region.

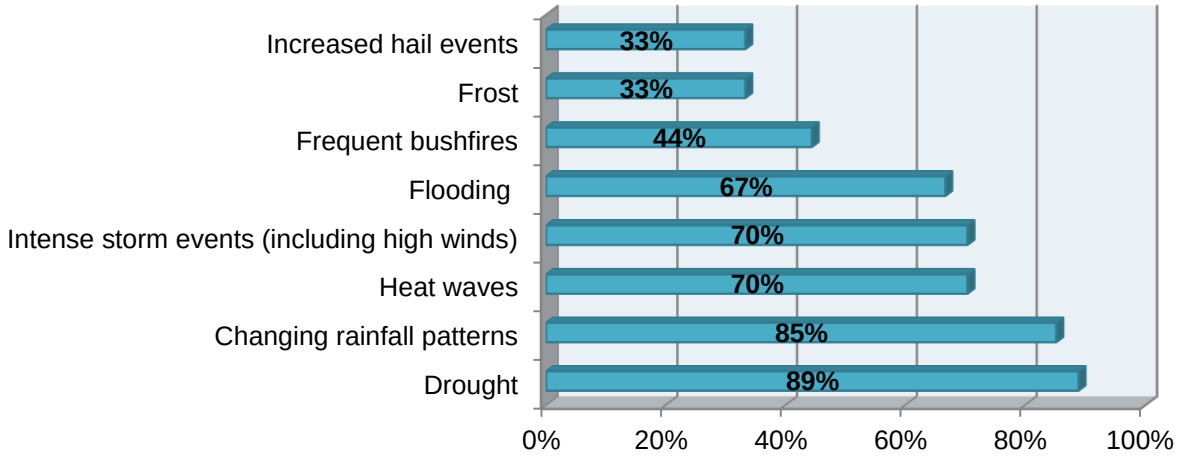

Figure 19: Climate risks identified for the Far West region

Importance of climate change

A series of questions was asked to ascertain the importance of climate change adaptation from individual and organisational perspectives. The initial survey showed that just over half (54%) of respondents agreed that climate change adaptation is important to them personally and in their professional roles. Similarly, less than half (49%) indicated that climate change adaptation was a moderate to strong priority for their organisation and 29% considered it a slight priority. Less than 10% said it was not a priority. The follow-up survey showed a slight increase (69%) in the importance climate change has for individuals.

Adaptation action

The surveys explored the wide range of adaptation actions that organisations or individuals had been involved with in the past, action they are currently engaged in, and actions likely to occur in the future (Figure 20).

The top four adaptation actions from the initial survey undertaken either in the **past** or **present** included:

- education and awareness raising for staff and communities
- encouraging the emergency management sector to account for climate change
- assessing the risks posed by climate change
- undertaking a vulnerability assessment.

Surprisingly, these were also the most frequently identified **future** actions.

The follow-up survey shows the growing importance of mapping the physical impacts of climate change (e.g. heat mapping) and building trust, networks and partnerships.

Securing funding for planning and implementing adaptation actions was not identified as a current action and was the least important future action in the initial survey. Furthermore, developing an adaptation plan and building infrastructure in locations that are less exposed to climate extremes were least pursued adaptation actions in the initial survey. In the follow-up survey, conducting a vulnerability assessment for the region and undertaking research to support adaptation were the least pursued options.

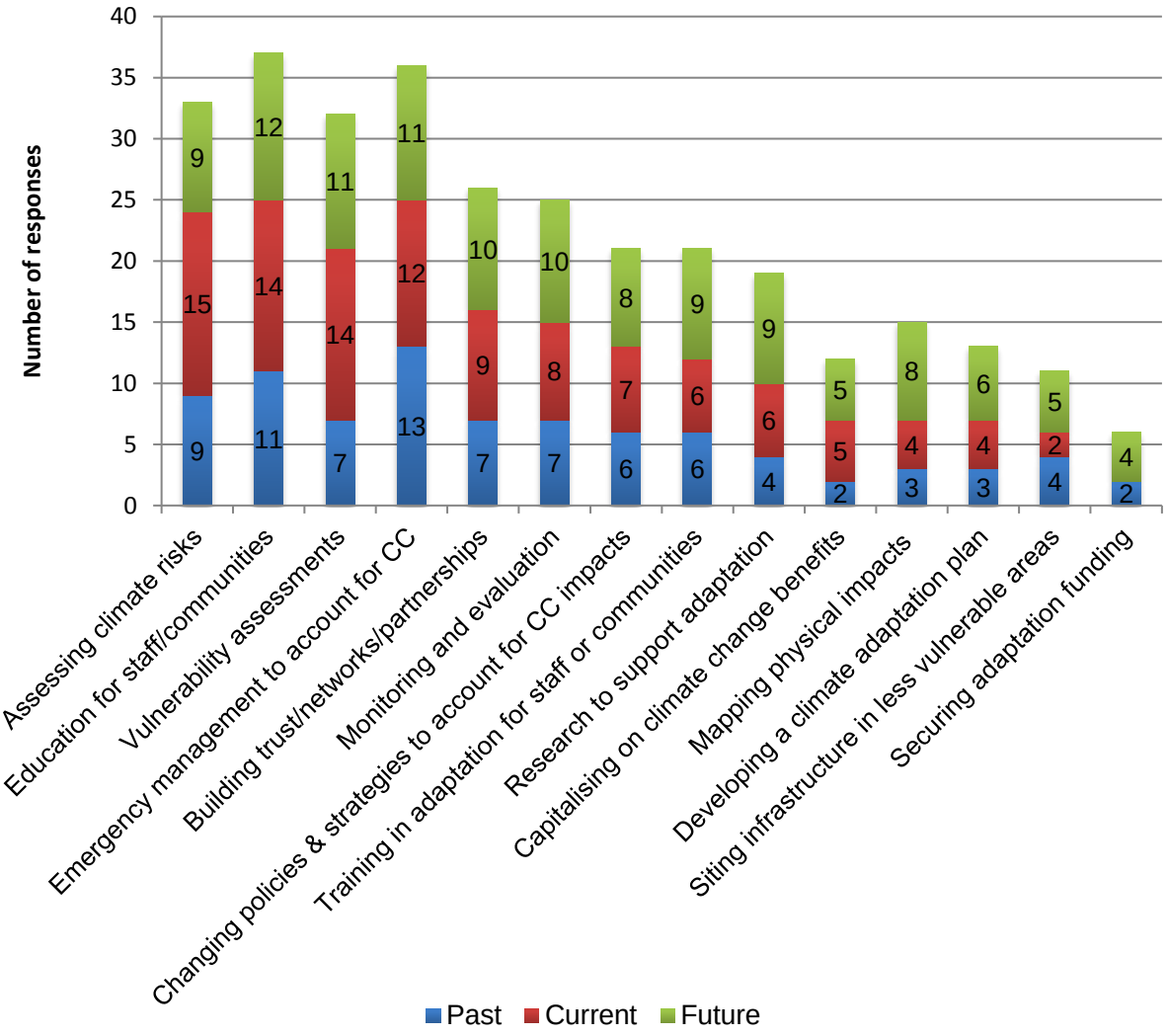

Figure 20: Adaptation actions across temporal scales

Adaptation actions can span multiple scales, sectors and responses, as shown in Figure 21. Key adaptation actions conducted at a local or regional scale from both surveys included awareness raising, educating and training agency staff or the community, working with the emergency management sector to account for climate risks in their planning, assessing climate risks, and developing a climate adaptation plan.

The initial survey indicated that building social capital is also important at a regional scale through building trust, expanding networks and nurturing partnerships. Assessing climate risks was identified as the main action undertaken by the state, presumably through the AdaptNSW portal; whereas the follow-up survey identified mapping the physical impacts of climate change, and changing policies and strategies to account for the impacts of climate change as important at a state scale.

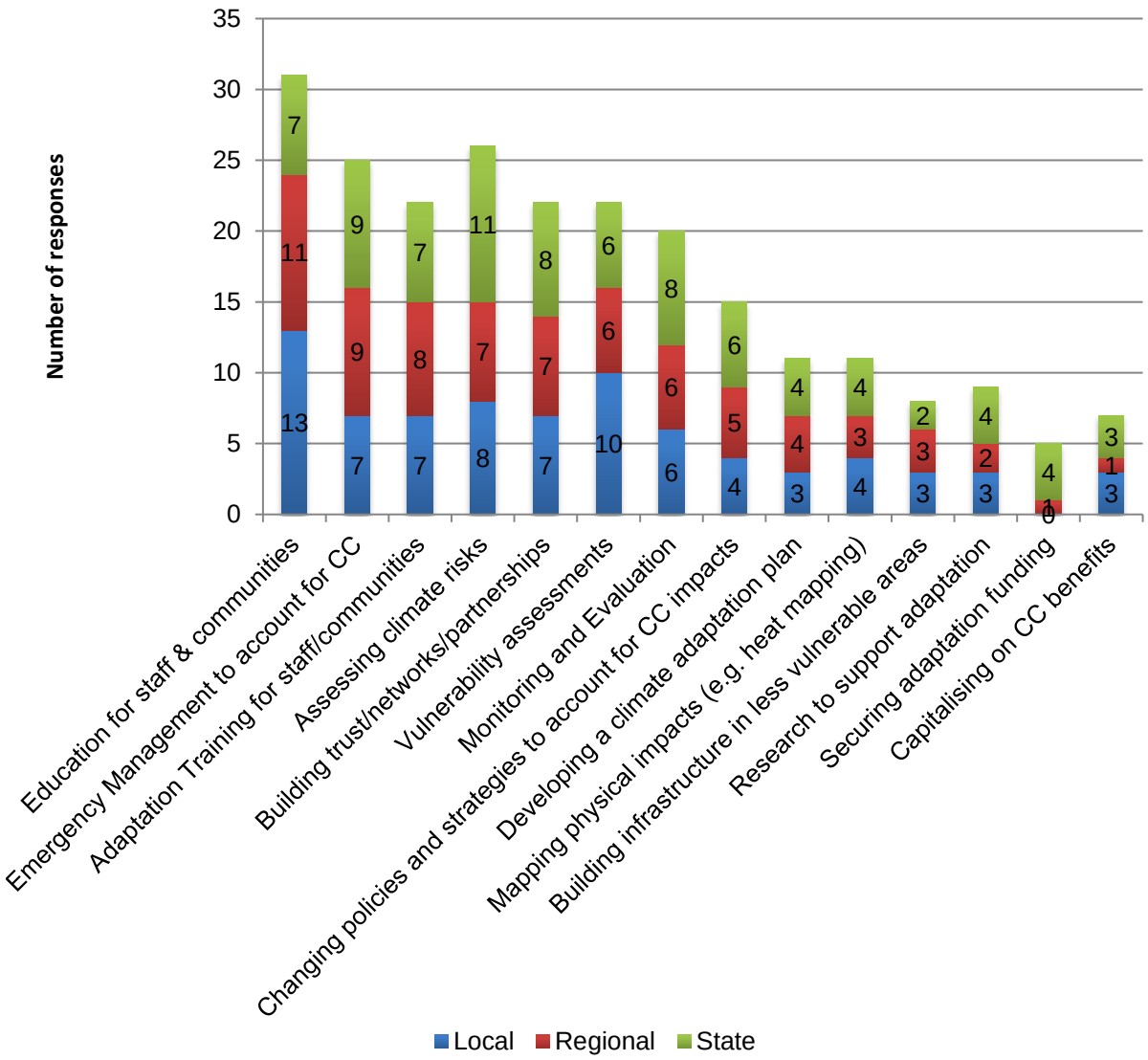

Figure 21: Adaptation actions across geographical scales

Organisational capacity to undertake climate change adaptation

The survey also explored organisational capacity to undertake regional adaptation actions. Organisational capacity can be broken down into seven key areas:

1. Awareness of the impacts of climate change
2. Knowledge and skills to adapt to a changing climate
3. Resources to undertake regional adaptation action
4. Engagement with the community and organisations within the region
5. Strategic planning
6. Funding for adaptation
7. Implementation of regional adaptation.

Median responses to the capacity assessment statements suggested that the region is generally constrained in its capacity to adapt. The responses indicated that regional adaptation was uniformly constrained by all the attributes of capacity although there was some variation in individual responses. Respondents to the follow-up survey conducted after

the workshops indicated that adaptation was most heavily constrained by the lack of a dedicated funding stream.

Regional adaptation initiatives

The surveys aimed to gain a deeper understanding of the specific types of adaptation actions that had taken place in the region. Some of the adaptation actions identified focused on key areas of importance to the region such as agriculture, natural resource security, energy, community engagement, and training and mentoring staff in resilience to boost their ability to adapt to changing circumstances.

Agriculture

Agriculture is increasingly focusing on the implications of climate variability through, for example, the breeding of plant species to improve drought tolerance and improvements to farming and rangeland grazing systems. Another initiative provided guidance to farmers about how to incorporate climate variability in their business plans and strategies and tips to apply for funding and low interest loans to cope with the variability.

The Bureau of Meteorology and the CSIRO conducted presentations to landholders in the region; however, some of the presentations were heavily science-based and used language that was difficult for an intelligent lay audience to follow. A key lesson learned from the process was the need to ensure data is presented in language that is accessible to the audience. Ultimately, landholders want to know how the information presented relates to their farm and the decisions they need to make.

Natural resource management

In natural resource management one initiative, the Off Stream Water Storage Project, sought to increase water security in the region through utilisation of disused gravel pits as water storages. These pits have reduced evaporation rates and allow for better management of water quality because of their reduced surface area and greater depth compared to the other major water sources.

A Natural Resource Management Plan was developed by incorporating climate change projections and impact information into prioritisation tools and documents to promote implementation of adaptations actions.

Energy

Efforts to increase energy efficiency has seen the biggest rollout of LED street lights in regional NSW, resulting in large energy and cost savings. The success of this project is attributed to securing access to funding and continued persistence.

Community health and safety

Adaptation actions in the health sector relate to the development of health and safety priorities, systems and processes in workplaces, to reduce vulnerabilities to a changing climate. The project was implemented due to a greater acceptance of changing work health and safety obligations for workers and businesses.

Community education and awareness raising events

In 2008, a Climate Change Conference was held in partnership with Inverell Shire Council that focused on climate change adaptation. Over 120 people attended the conference and the positive feedback from attendees indicated an increase in community understanding and knowledge. These community engagement and awareness raising events were successful

because they were delivered at the local scale using a coordinated, statewide approach. However, it was noted that the message about climate change is difficult to convey.

Biodiversity

The *Saving our Species* program in NSW is currently looking at prioritising the funding for threatened species projects. Species that are predicted to be more adaptable or less susceptible to climate change in the future are prioritised. Work is being planned to list threatened species in western NSW, which will include assessments to measure risk from climate change impacts.

Heat

NSW Land and Housing Corporation 2017–18 strategic plans are being updated to take advantage of the NSW Climate Action Plans scheduled for release in July 2017. New strategies that are being developed include a heat policy for outdoor workers and improvements to human comfort. Air-conditioning and solar PV systems are being retrofitted in up to 276 social housing properties in the next six months.

Monitoring and evaluation of adaptation actions

Programs, research and recommendations require continual monitoring, evaluation and adjustment to ensure they meet the needs of the regional communities in a dynamically changing environment. The final survey question asked whether monitoring and evaluation (M&E) of adaptation initiatives are undertaken on a regular basis. About 40% of respondents indicated that M&E was not being undertaken, 21% that M&E occurs infrequently and only 10% affirmed that adaptation actions were being regularity monitored and evaluated.

7 How to turn these findings into action

This report contains a collective understanding of the likely vulnerability to climate change of the Far West region and aims to stimulate action to plan adaptation. It documents regional challenges and actions identified by local decision-makers as critical to their community's prosperity and endurance. Local councils and state agencies will need to continue to collaborate and look for opportunities and policy windows to enable transformation of the seven systems identified in this report.

To address the region's vulnerability to climate change, begin by pursuing the following opportunities and be on the lookout for new ideas as well:

- **Understand regional vulnerability** – Table 3 of the report outlines the exposure and sensitivity of the region to climate and other regional drivers of change. It provides a lens through which the specific attributes of the region can be viewed as a means of addressing threats (adaptive capacity). It can also help to identify what attributes are absent or negative, highlighting which adaptive responses will be constrained, leaving the region vulnerable.
- **Understand the flow-on impacts of climate shocks and stressors across the community** – The impact chains in Figure 16 show how climate variability and extreme events will affect the region and illustrate the complexity of consequences from the four main climate drivers that were identified.
- **Assess climate change adaptation progress in the region** – The survey results in Chapter 6 outline the key climate risks and the status of adaptation currently underway. This provides a benchmark against which future action can be measured.
- **Embed the transition models into regional and local strategic plans** – The transition models look at key regional systems that will need to be significantly different in the future due to climate change, and other specific regional drivers of change. Embedding the actions in the transition pathways into project and program development will aid cross-sectoral adaptation and support regional efforts to transform to a desirable future. This can be achieved through strategic planning or operational opportunities.
- **Seek funding to activate transition pathways** – The assessment method used to identify the regional vulnerabilities is a peer reviewed methodology, meaning it provides a robust and scientifically rigorous way to prioritise adaptation projects and responses. It provides a sound evidence base to support adaptation projects and justify subsequent investment.
- **Communicate the expected physical changes** – Table 2 and Appendix A summarise the changes to climate variables that can be expected in the future and also the likely impacts across different sectors. Community education and staff training will help the whole region to increase its preparedness.
- **Leverage existing cross-jurisdictional leadership groups** – These groups are central to coordinating and driving climate change adaptation in the Far West region and are a valuable resource to help build momentum.

Appendix A: Expected physical responses to climate change for the Far West

Physical response	Trend	Projection	Implications
Heat	Increase	Heatwaves are projected to occur more often, be more intense and last longer. Across most of NSW there will be more days over 40°C. For further information refer to *Minimising the impacts of extreme heat: A guide for local government*: climatechange.environment.nsw.gov.au/Adapting-to-climate-change/Local-government	• Human health • Urbanisation • Biodiversity • Fire weather • Agricultural productivity
Hillslope erosion	Increase	Areas which already experience high erosion rates are projected to see increases in erosion. For this region, the erosivity is projected to increase by 11% in the near future and 29% in the far future. For further information refer to *Soil Erosion Climate Change Impact Snapshot*: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Soil/Soil-Erosion	• Water quality • Agricultural productivity • Biodiversity
Soil properties (SOC, pH and sum of bases)	Increase – decrease	This region is projected to experience only marginal change in SOC, with some areas undergoing a slight increase and others undergoing a slight decrease. In the region, pH is projected to become more acidic in both upper and lower soil depths for both the near and far futures. Macro-nutrients undergo marginal change in the near future but increases in the far future, particularly in the upper depth. For further information refer to *Soil Properties Climate Change Impact Snapshot*: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Soil/Soil-Properties	• Agricultural productivity (+ and –) • Natural ecosystems
Rainfall erosivity	Increase	In this region rainfall erosivity will increase in summer and autumn in both the near and far futures. Changes to winter and spring erosivity are less clear due to the complex nature of the projected changes in rainfall in those seasons. However, increases are projected for all seasons by the far future. For further information refer to *Rainfall erosivity* in the *Soil Erosion Climate Change Impact Snapshot*: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Soil/Soil-Erosion	• Water quality • Agricultural productivity • Biodiversity
Rainfall extremes	Increase	Rainfall extremes are projected to increase in the near future and far future. For further information visit the Adapt NSW website: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Floods-and-storms	• Flooding • Agricultural productivity • Emergency services • Local government

Physical response	Trend	Projection	Implications
Flood		For further information visit the Adapt NSW website: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Floods-and-storms	• Urban and rural properties • Agricultural productivity • Emergency services • Local government
Hydrology (surface flow/ runoff and recharge)	Increase	The projections for changes in surface flow in the Far West show little variability in trends across seasons. In the near future, less surface runoff is likely across large areas of the region; however, more runoff is projected in the far future across all seasons, particularly during summer. On an annual basis, less recharge is likely across southern parts of the Far West region in the near future. Higher recharge is likely in the north-eastern parts of the region. In the far future, more recharge is projected over most of the region, with the largest increases in northern areas. For further information refer to *Hydrology Climate Change Impact Snapshot*: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Water-resources/Groundwater-recharge-and-surface-runoff	• Councils' stormwater infrastructure • Town water supplies • Agricultural productivity
Drought	Increase	For this region, time spent in drought is projected, with medium confidence, to increase over the course of the century. For further information see the CSIRO and BoM Technical Report (2015): www.climatechangeinaustralia.gov.au/en/publications-library/technical-report/	• Human health • Town water supplies • Agricultural productivity • Biodiversity
Evaporation	Increase	Likely increase across all seasons. For further information refer to *Hydrology Climate Change Impact Snapshot*: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Water-resources/Groundwater-recharge-and-surface-runoff	• Agricultural productivity • Biodiversity • Water security
Fire weather	Increase	Average and severe fire weather is projected to increase in summer, spring and winter, however decrease in autumn (taking into account increases in autumn rainfall). It is important to note that due to the predominance of grasslands in this region fire risk may be more accurately accessed using the Grass Fire Danger Index. For further information visit the Adapt NSW website: climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Bushfires	• Fire regimes • Emergency services • Hazard reduction

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