



# RESILIENCE ACTION PLAN

Tarnagulla Community  
Victoria, Australia  
June 2020



# Acknowledgments

This report was authored by Mittul Vahanvati, lecturer and researcher at RMIT University Centre for Urban Research, in collaboration with the Tarnagulla Alternative Energy Group (TAEG) members - Linda Jungwirth, Kelly Whitton, George Filev, Leigh Mellberg, Paul Davis, Julie Davis, Carmen Scull and Barry Condick. The report was developed for the Tarnagulla community, by the Tarnagulla community.

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**We acknowledge that Tarnagulla township is on Dja Dja Wurrung Country.**

The Dja Dja Wurrung Clan are bound to their land by their spiritual belief system deriving from the Dreaming, when mythic beings had created the world, the people and their culture. They were part of established trade networks which allowed goods and information to flow over substantial distances.

Their lands extended over 16,000 square kilometers, embracing the Upper Loddon and Avoca rivers, running east through Maldon and Bendigo to around Castlemaine and west as far as St. Arnaud. It took in the area close to Lake Buloke. The northern reaches touched Boort and to the northwest, Donald. Creswick and Daylesford marked its southern frontier and to the southwest, Navarre Hill and Mount Avoca. Stuart Mill, Natte Yallock, Emu and the eastern headwaters of the Wimmera River all lie within Dja Dja Wurrung traditional land.

We express our gratitude in the sharing of this land, our sorrow for the personal, spiritual and cultural costs of that sharing and our hope that we may walk forward together in harmony and in the spirit of healing.

We pay our respects to leaders and Elders past, present and emerging for they hold the memories, the traditions, the culture and the hopes of all Dja Dja Wurrung people.



Photo on cover page: Tarnagulla Township  
(Credit: Linda Jungwirth, President, TAEG)

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Church in Tarnagulla, built during Federation times  
(Credit: Mittul Vahanvati)

## Executive summary

The Tarnagulla Alternative Energy Group (TAEG) was established in 2017 to develop a Resilience Action Plan (RAP) for the Tarnagulla community. A grant from DELWP enabled the local group to engage RMIT researcher, Dr Mittul Vahanvati to work collaboratively with TAEG members and the community to co-produce the Tarnagulla Community Resilience Plan (TCRP).

Tarnagulla, located in Central Victoria's Golden Triangle, was historically a gold mining town, but now its predominant industry is agriculture. The town has a population of 133 people, surrounded by Box Ironbark forests and is at high risk from bushfires, droughts and storms. Without the support, Tarnagulla township, like the 1,700 other small towns in Australia (approximately 9.7% of the total population) are at risk of disappearing due to reduction in population, deteriorating buildings, low economic prospects and climate risks.

A co-production method was adopted for this research to support the Tarnagulla community in planning for actions for future resilience. The project was divided into three phases: i) an increase in awareness, trust and participation, ii) community identification of strengths, challenges, vulnerabilities and adaptive capacities to identified climate scenarios, and iii) development of a resilience action plan. Data was elicited through a series of eight workshops, involving an average of 17 attendees per workshop, totaling 230 participants. Actions derived by the community were prioritised through a citizen jury and later tested during a stakeholder workshop. EMV and other stakeholders including SES, CFA, Loddon Shire Councillors, local Victorian police, and health sector members contributed to testing of actions against a climate scenario.

The Tarnagulla community defined their vision for a resilient future as:

"The Tarnagulla community of the future will be different. Together we will work towards developing and sustaining a thriving town. We will have a strong social culture built on a diverse and connected population representing and welcoming peoples of all ages, status, ethnicities and interests. We will have a beautiful town with a sustainable economy built on local agriculture, businesses, clubs, organisations and tourism. To be resilient we will have developed the necessary capabilities to confidently address our future."

- Project Leadership Group

The following actions were prioritised by the community to achieve their vision:

1. Facelift for Tarnagulla (physical capital)
2. Boost the local economy (economic capital)
3. Establish reliable sources of energy (physical and economic capital)
4. Strengthen community spirit (social capital)
5. Improve access to health services, public transport and emergency evacuation plan

These actions may signal the community opted for more socio-economic-technical actions, yet, the community realises their basic needs must be met and sustained to provide the basis for building their capacity to cope with natural hazards and changing climate(s). Beyond the development of a community RAP, the co-production approach has provided additional benefits to the participants and the Tarnagulla community. Now the main challenge remains in maintaining continued momentum required to implement identified actions.



# 1. Introduction

The Tarnagulla community wishes to maintain a thriving and resilient future and prevent undesirable future trajectories in the context of the many challenges, including climate change. In order for them to better adapt into the future and not leave their future to chance or to others, the RAP intends to outline a suite of tailored actions for their town, to proactively and continually develop their capacities to build their collective, individual and institutional resilience.

This document sets out why the town and place-based community set out to develop a resilience action plan, followed by the method used and their findings. The report also discusses the (anticipated and unanticipated) benefits of a co-production approach followed by further steps essential for this Plan to lead to Tarnagulla community's successful climate change adaptation.

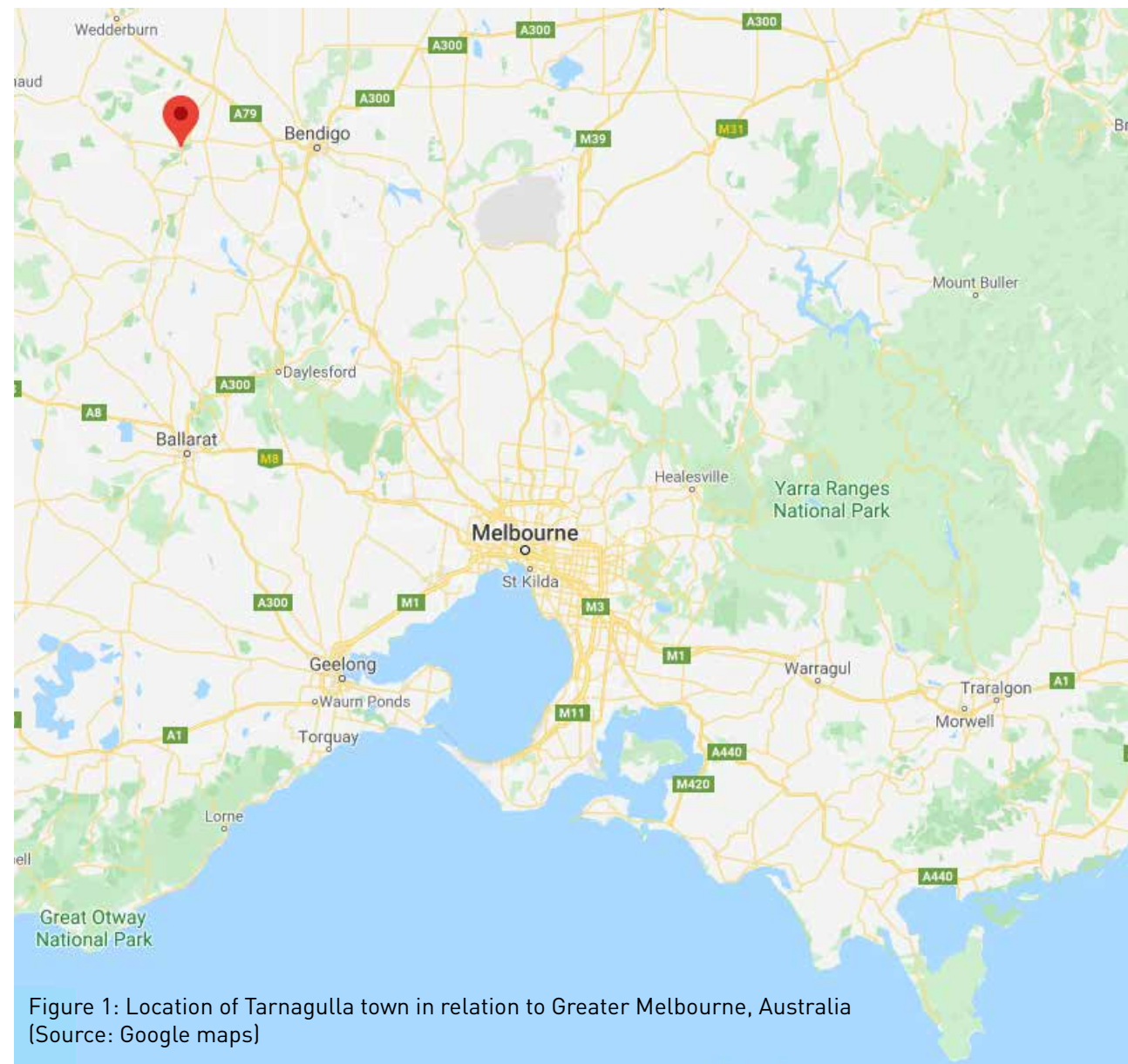


Figure 1: Location of Tarnagulla town in relation to Greater Melbourne, Australia (Source: Google maps)

# 2. Why does Tarnagulla need a Resilience Action Plan?

The Tarnagulla community, like many other rural communities (e.g. Inglewood, Wedderburn), face many development and climate-related challenges. The demographics of Tarnagulla (Figure 12, page 29) have a reducing and aging population with one-third of the population occupied in care (i.e. living at home and unable to be employed). Some of the ongoing challenges facing the Tarnagulla community include, unreliable electricity, long distances from business opportunities, lack of adequate public transportation, lack of health care facilities and threat from bushfires, occasional floods, droughts, and storms.

Climate change is only going to exacerbate present challenges by an increase in the frequency and intensity of extreme events such as storms, intense rainfall, droughts, heat waves (IPCC, 2014).

TAEG, established in 2017, understands that community connection, happiness and wellbeing underline their vision for developing the RAP.

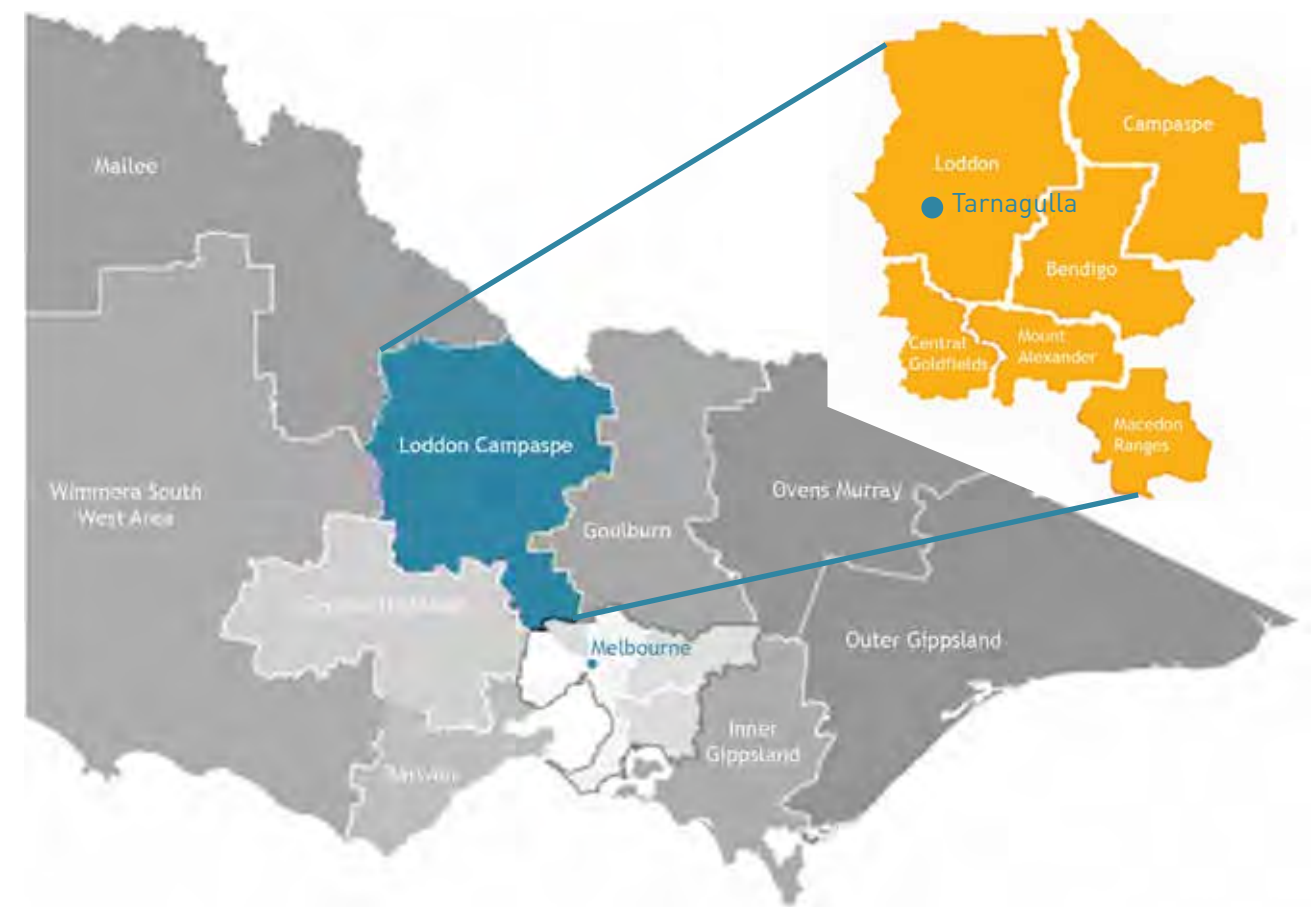


Figure 2: Left - Loddon Campaspe Region, Victoria (Source: Adapted from Department of Education and Training, 2019); Right - Six municipalities in the region (Source: Regional Development Victoria, 2019)



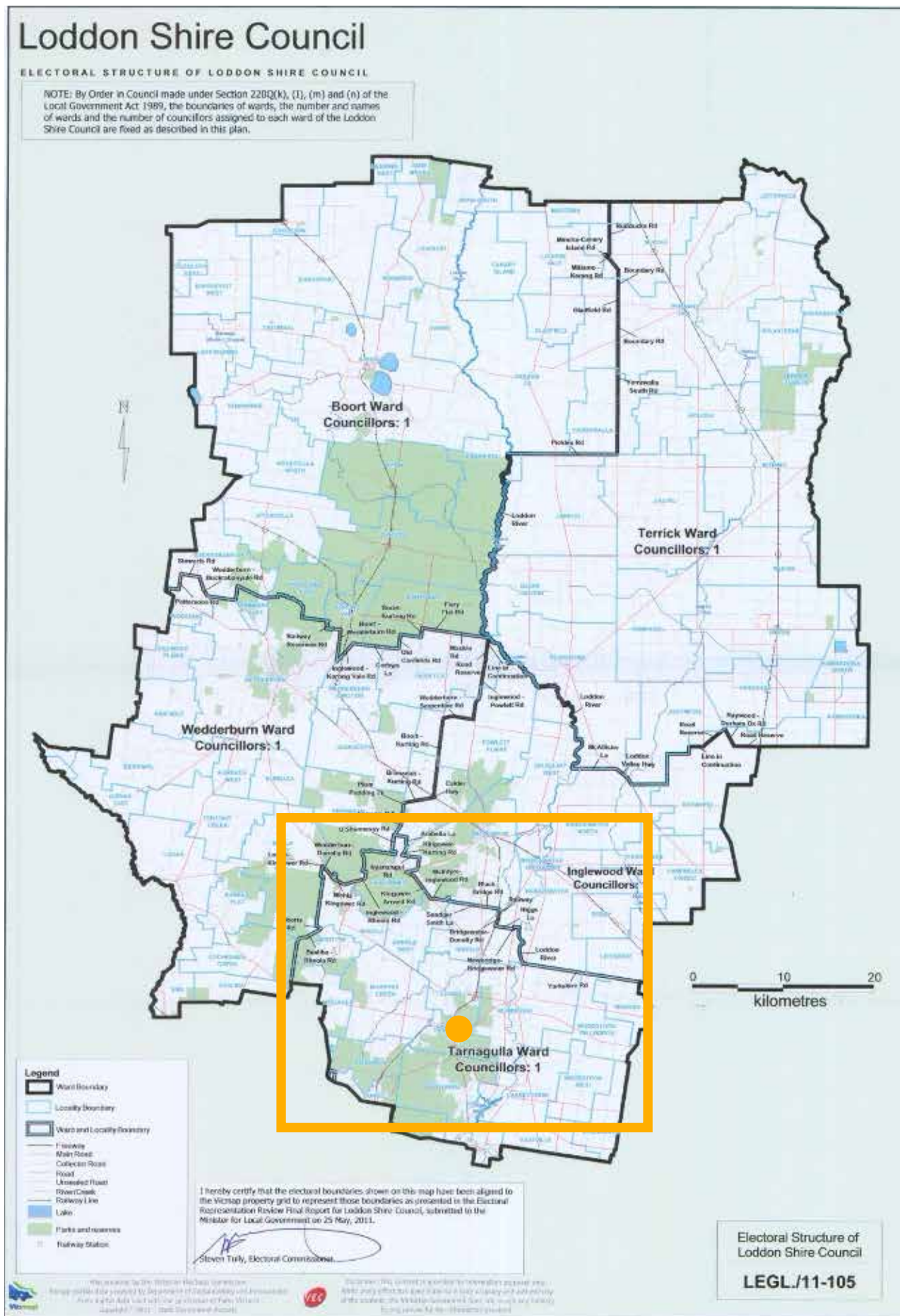


Figure 3: Electoral structure of Loddon Shire Council with the Tarnagulla Ward shown in orange box (Source: Loddon Shire, 2020)

### 3. Research questions, aims and objectives

The aim of this project is for the RMIT researcher to work with TAEG and the Tarnagulla community to co-produce their own RAP to adapt to the climate change.

To achieve this aim, the project seeks to answer the following research questions:

- Q1. How does the community’s definition of resilience relate to those within relevant literature?
- Q2. How effective is the community resilience framework in helping communities identify, define and analyse their strengths and challenges?
- Q3. To what extent does co-production of the RAP lead to community-led initiatives (and eventually actions) that theory suggests could actually ‘build resilience’?

To achieve the aim and answer the research questions, the project’s objectives are:

- To develop a mutually agreed definition of community resilience between the Tarnagulla Project Leadership Group (PLG) and the RMIT researchers
- To apply the community resilience framework to this project, in order to understand and document community strengths and challenges, in the context of a changing climate
- To help mobilise and empower the wider community to participate in co-producing the community RAP with the PLG and RMIT



Some of the Tarnagulla town community members (Credit: Linda Jungwirth)



# 4. How was this Plan developed?

## 4.1 Research methodology

A predominantly qualitative, co-production methodology is adopted for this research with limited use of quantitative methodology.

In line with the three research questions, the research methodology for the project is divided into three phases (Figure 4), as:

- Phase 1.** An increase in awareness, trust and engagement of the Tarnagulla community
- Phase 2.** Identify, document and analyse the community's current strengths and challenges in the context of climate change
- Phase 3.** Develop the RAP

Phase 1 (Figure 4) involved establishment of the 'Project Leadership Group' (PLG) as the core group to serve as a backbone for and lead the project.

This [a co-production] methodology is appropriate [for this research] considering resilience cannot be imposed on a community by external stakeholders in a top-down manner; communities must be empowered to take collective action. A co-production method assists to frame resilience collaboratively and the project is process-driven and outcome-oriented."

- Vahanvati 2020, p.2



Tarnagulla community coming together during Project launch event  
[Credit: Carmen Scull]

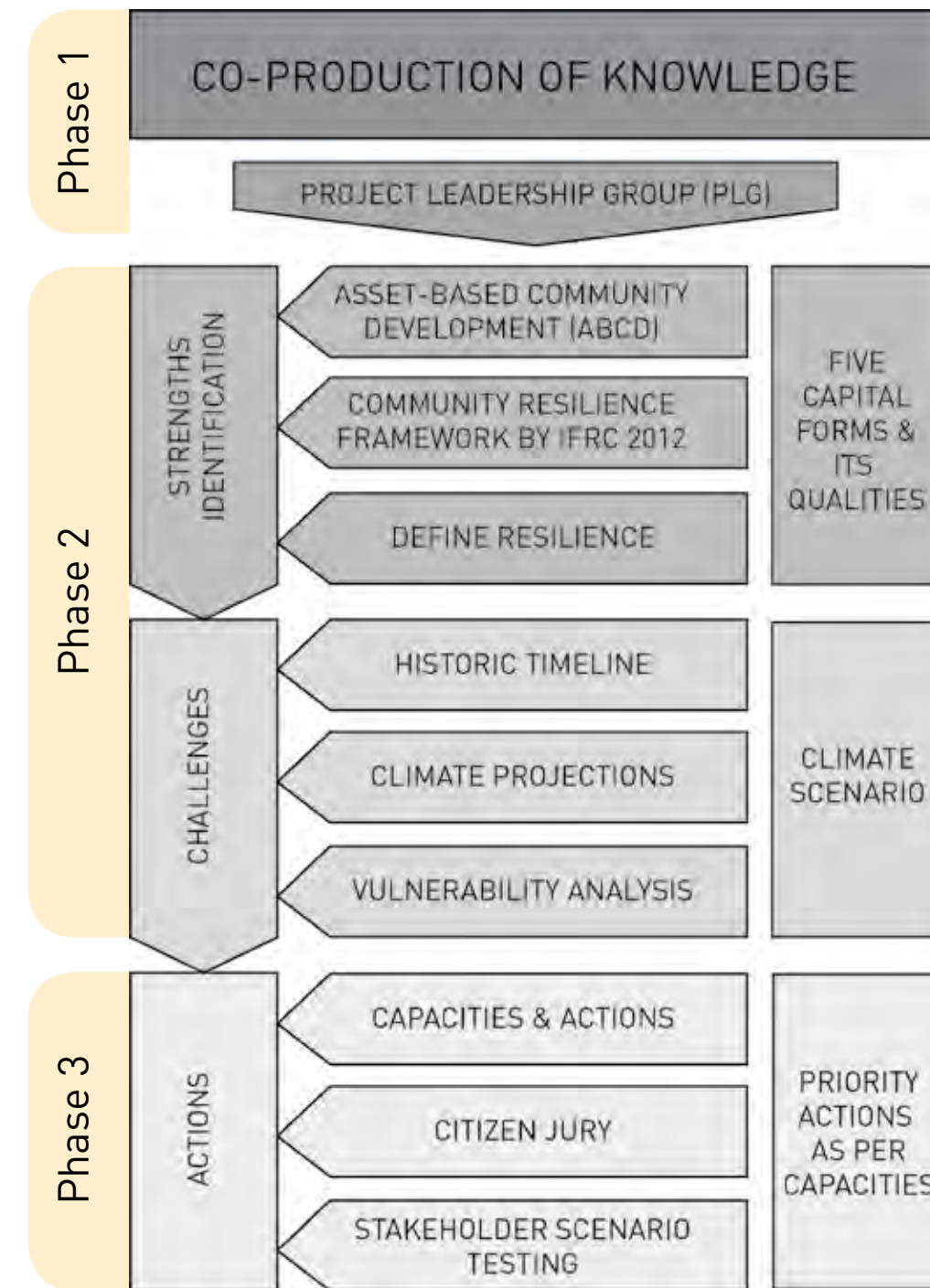


Figure 4: Research methodology for the Resilience Action planning with the Tarnagulla community  
(Source: Vahanvati 2020, p.4)

Phase 2 (Figure 4) involved framing and defining the concept of resilience as well as identifying strengths and challenges. Resilience thinking provides a useful framework for addressing the uncertainties of climate change and on-going developmental challenges. Resilience thinking necessitates understanding complex challenges from the perspective of the community's worldviews, values, beliefs and perceptions, in order to unearth systemic patterns, processes and root causes of vulnerabilities.

The theoretical framework for community resilience developed by the International Federation of Red Cross and Red Crescent Society (IFRC, 2012) (Figure 5) was found appropriate to use to identify the Tarnagulla community's existing strengths and capacities.

As per IFRC (2012), community resilience relies on the following:

- basic needs
- six asset types (owned by individuals/ community)
- resources (external assistance),
- qualities of those assets, and
- capacities of community

The five capital forms or assets as per IFRC (2012), are used to identify strengths within community from a broader and integrative consideration. The framework distinguishes between assets that are owned and controlled by the community versus resources that are external.



Figure 5: A conceptual framework for community resilience (source: International Federation of Red Cross and Red Crescent Societies (IFRC, 2012).

The challenges are categorised into general development related and climate change-related.

- Climate scenarios are developed by combining community observations about past hazard events and scientific data on climate projections and
- Vulnerability assessment = exposure x sensitivity / adaptive capacity

Three climate scenarios were developed by comparing the scientific data (though constantly evolving) with historic observations. For each of these climate scenarios, sensitivity – in terms of who and what is most vulnerable to the impacts of hazards and climate change was identified.

Phase 3 involves action planning for future resilience to climate change and general challenges. The Three Horizons chart developed by the International Futures Forum (IFF, u.d.) is adopted for resilience action planning. This chart provides a simple, yet practical framework for thinking about the future. The actions required to reach an envisioned future are determined collectively, by describing three patterns of activities and by envisaging how their interactions can potentially play out over time. During the process, the Tarnagulla community also determined their capacities to cope, recover, adapt and transform to such climate scenarios. These capacities or capacity deficits informed the identification of actions. Once the actions were determined, five of these actions were prioritised democratically through a citizen jury workshop. Later, these actions were tested against a climate scenario along with many stakeholders.

## 4.2 Data collection and analysis

Data, both qualitative and quantitative, was produced through a series of eight collaborative workshops, two community events and three surveys (Table 1). For over 18 months, the PLG and the RMIT Researcher (with support of DELWP) met for monthly focus group discussions. These meetings helped with refinement of the project, data collection, data analysis and compiling community feedback at various stages of reporting. The project has gained approval from the RMIT College Human Ethics Advisory Network (CHEAN) in accordance to the National Statement on Ethical Conduct in Human Research (National Statement).

Table 1: Three phases and a series of collaborative activities for Resilience Action Planning, Tarnagulla (Source: Author)

|                |   |
|----------------|---|
| <b>PHASE 1</b> | <b>An increase in awareness, trust and engagement of the Tarnagulla community in planning of the project as a result of Phase 1 activities</b>  |
|                | <ul style="list-style-type: none"> <li>• TAEG to establish the Project leadership group (PLG)</li> <li>• RMIT to complete Project Plan for endorsement by the PLG and DELWP</li> <li>• Online website/ social media presence</li> <li>• 1 x community event (organised by the PLG)</li> <li>• 1 x survey (online and hardcopy, co-developed by the PLG and RMIT)</li> <li>• 1 x community workshop (facilitated by RMIT)</li> </ul> |
| <b>PHASE 2</b> | <b>An improved understanding among Tarnagulla community about the current areas of their strengths and challenges in the context of climate change</b>  |
|                | <ul style="list-style-type: none"> <li>• A report on current community strengths and assets, launched at a community event (developed by RMIT, endorsed by the PLG)</li> <li>• 3 x community workshops (facilitated by RMIT)</li> <li>• Survey (online and/or hardcopy) for response to draft report uploaded on website (survey co-developed by the PLG and RMIT)</li> </ul>   |
| <b>PHASE 3</b> | <b>An improved understanding of, aspirations for and avenues for building resilience among community as reported in the Resilience Action plan</b>  |
|                | <ul style="list-style-type: none"> <li>• 3 x community workshops (facilitated by RMIT)</li> <li>• Info session for community and stakeholder feedback</li> <li>• 1 x survey (online and/or hardcopy) (survey co-developed by the PLG and RMIT)</li> <li>• Conversation activities (coordinated by the PLG)</li> <li>• 1 x community event (organised by the PLG)</li> </ul>   |

Quantitative data was gathered in the form of the number of participants at each workshops, events and surveys. Data on community engagement was gathered through keeping a record of head counts through sign-in sheets during each workshop or event. Three survey questionnaires were conducted face-to-face as well as online. The first survey was conducted at the start of the project, in a fun, play-based manner, to get a demographic understanding and to define resilience. The second survey was conducted mid-way through the project to incorporate community feedback in the draft of strengths and challenges report. This survey was conducted remotely via hard copies (distributed through the local post office) as well as online via TAEG website and Facebook page. A third survey was conducted towards the end of the project to incorporate community feedback in



the draft RAP report. The purpose of collecting quantitative data was to demonstrate engagement, assess the commitment and demonstrate change in perceptions or values of the Tarnagulla community living, working or associated with the town, over the duration of this project.

Qualitative data was gathered during each workshop by varied means. With approval from the participants, workshop discussions were audio recorded, video recorded and photographed. All interactive activities (e.g. writing on butcher paper) were scanned. Thematic content analysis was used for the analysis of qualitative data, and clustered into capital forms based on IFRC (2012) community resilience framework.

## 5. Phase 1: Building trust and defining resilience

To ensure effective and meaningful engagement, involved the establishment of the PLG, development of a comprehensive community engagement and communication plan, determination of roles and responsibilities of the PLG, development of guiding principles for this project (Figure 6) and the community's definition of the concept of resilience.

### 5.1 Project Leadership Group establishment

The PLG comprised of seven local people who are already part of TAEG. Since the PLG members had already established trust with the Tarnagulla community by being part of the TAEG, they acted as community champions and worked as a conduit between the RMIT researchers and the community. Since the inception of this project in May 2018, the PLG ensured the project ran smoothly, and thus formed an essential part of the co-production approach.



Figure 6: Principles to guide the Tarnagulla Resilience Action Plan project







Tarnagulla community coming together during Project launch event  
(Credit: Carmen Scull)



Tarnagulla Township  
(Credit: Linda Jungwirth)

## 5.2 Resilience definition

Before beginning the project, it was important to define the concept of resilience, to ensure we all worked towards a shared vision.

The Tarnagulla community answered questions – resilience to what, when, of who or what, and when – to unpack the concept and for it to have practical significance in this project. Table 2 presents the meaning of resilience as unpacked by the individuals and community in Tarnagulla.

Table 2: The Tarnagulla community's definition of the resilience concept (Source: Vahanvati, 2020)

| Resilience                                 | Description   | % of Respondents |
|--|---|------------------|
| Meaning and attributes of resilience (how) | Well-functioning  | 40%              |
|  | Adaptable, able to manage unforeseen situations, recover, bounce back, sustain)       | 90%              |
|  | To transform/ Renew/ Long term/ Thrive/ Adapt   | 100%             |
| 'to what'                                  | Any expected or unexpected scenario/ unknown challenges                               | 80%              |
| 'when'                                     | Continuous - during times of need and times of prosperity                             | 80%              |
| Scale and state                            | Multiple scales (individual, community, local and regional)                           | 90%              |
| 'of who or what'                           | Social asset: Strong, trusting, informed and open-minded community, collective action | 100%             |
|  | Physical asset  | 80%              |
|  | Economic asset  | 80%              |
|  | Natural asset   | 20%              |
|  | Human asset   | 20%              |

As highlighted in Table 2, the majority of people in Tarnagulla (90-100%) defined resilience from a systems perspective and associated resilience with renewal, transformation and adaptation. Some of them described resilience as:

"The ability to manage the unforeseen in a manner that provides confidence to those affected and enables renewal in a purposeful manner that ensures all concerns and all environmental aspects are considered."

- PLG member

"Progressive in adversities"

- Workshop participant

The process of defining resilience unravelled a mixture of the complexities in understanding community values, preferences, expectations, capacities, contested knowledge, as well as uncertainties, as discussed in following sections. Figure 7 shows the capital forms prioritised by the Tarnagulla community for building their resilience.



The Tarnagulla community's vision for the future, in terms of what it would mean to be resilient is as follows.

The Tarnagulla community of the future will be different, and together we will work towards developing and sustaining a thriving town. We will have a strong social culture built on a diverse and connected population representing and welcoming peoples of all ages, status, ethnicities and interests. We will have a beautiful town with a sustainable economy built on local agriculture, businesses, clubs, organisations and tourism. To be resilient we will have developed the necessary capabilities to confidently adapt to our future.

- PLG members, TAEG

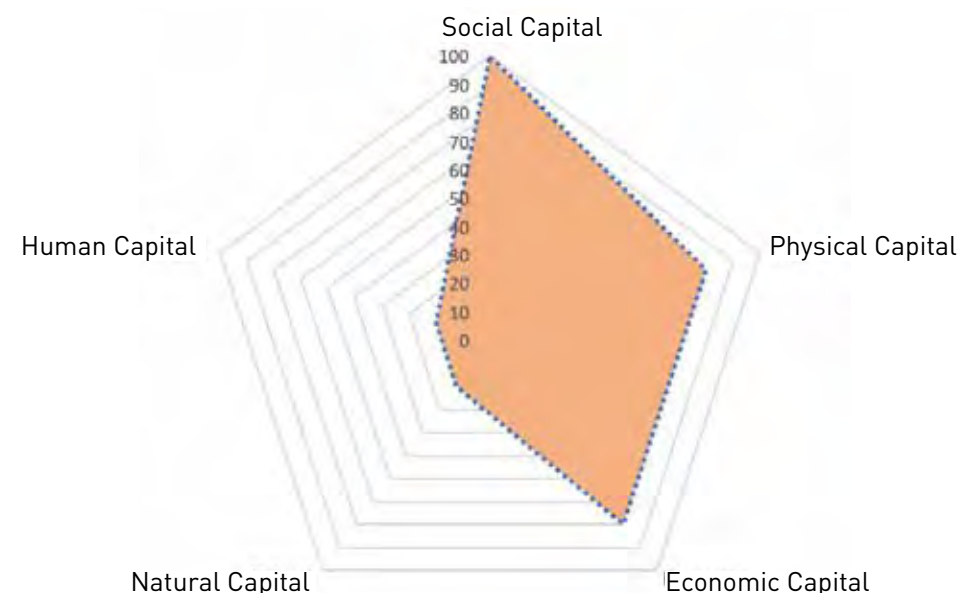


Figure 7: Resilience of what? - Capital forms prioritised by the Tarnagulla community to be resilient (Source: Author)



Participants engaged in workshop held at Tarnagulla (Credit: Carmen Scull)

## 6. Phase 2: Town profile, strengths, challenges and vulnerabilities

Phase 2 involved identifying strengths at a community and town scale, frame and define the concept of resilience and identify challenges, now and in future.

### 6.1 Existing strengths and assets

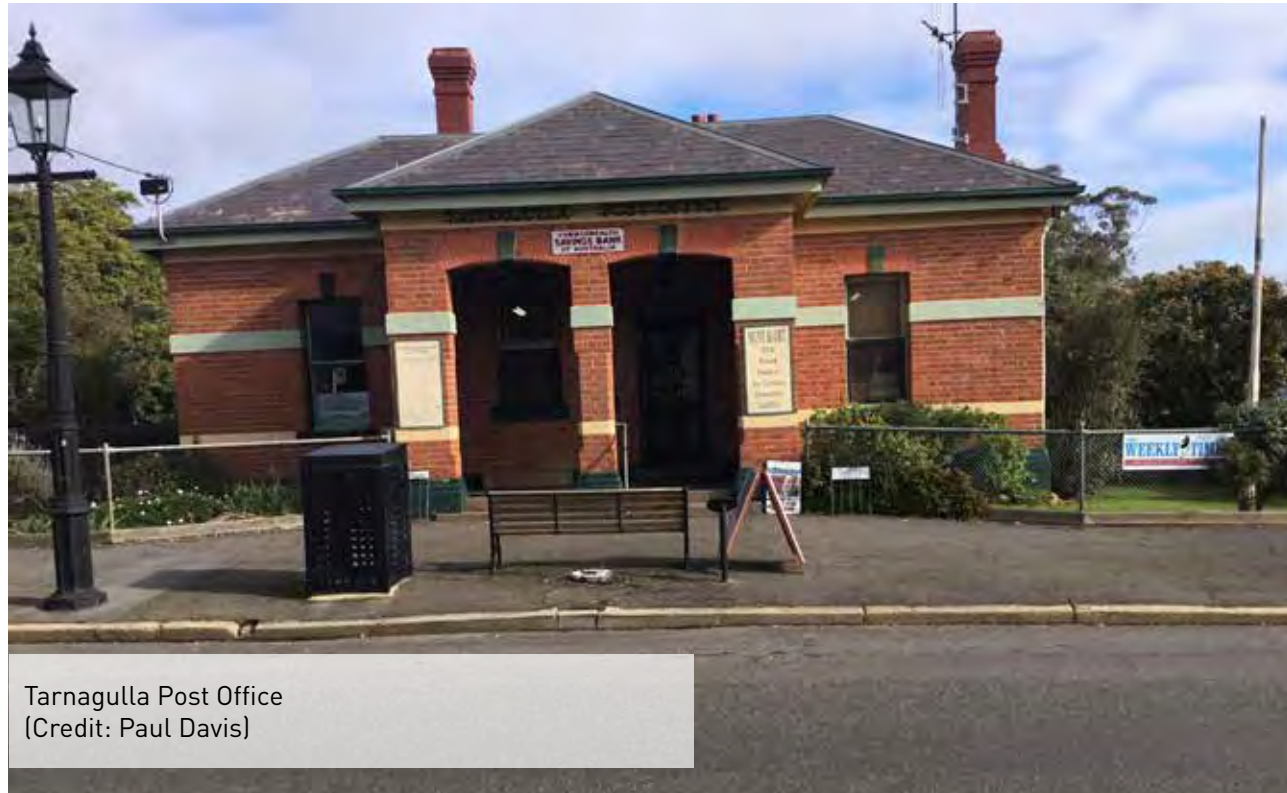
Existing strengths in the Tarnagulla community were identified and categorised into five capital forms. To identify strengths in the human and social capitals, the '5H' approach proposed by the Asset-Based Community Development Institute (2020) was used. The community reflected on the 5Hs – Head (things they know about and would love talking about to others), Hand (things they are skilled at), Heart (things they deeply care about), Heel (things that make them feel grounded) and Human connection (the things they all do to stay connected with their community). This exercise was followed by identification of strengths in other capital forms (Table 3).

Table 3: Strengths within Tarnagulla community categorised into capital forms

| Human capital                                   | Social capital   | Physical capital  | Natural capital                                     | Economic capital  |
|---|--|---|---|-------------------|
|   |  |   |   |                   |
| Teaching/education (maths, music)               | Senior citizens (1981)                                 | Pub   | Conservation reserve (Mallee)                       | Hotel             |
| Empowerment (youth engagement)                  | Loddon Southern Region Development & Tourism Committee | Historic precinct with heritage value buildings               | Historic mining (fossicking)                        | Post office       |
| Technical skills (wood and metal work)          | Tarnagulla Action group                                | Community hall  | Reservoir (fishing)                                 | Bed and Breakfast |
| Making (knitting, cooking, spinning wool, soap) | Parks and recreation group                             | Library   | Unique heat & drought tolerant Goldfields Grevillia |                   |
| Landcare and conservation                       | Neighbourhood watch                                    | Post office   | Wildlife (flora and fauna)                          |                   |
| Local history                                   | CFA  | Camp Ground at the Recreation Reserve                         | Bicycle track                                       |                   |
| Management (emergency, risk mitigation)         | Tarnagulla Alternative Energy group (TAEG)             | Walking and bicycle riding tracks                             |   |                   |
| Health and wellness                             | Cemetery trust   | One bus stop  |   |                   |
| Caring for pets and animals                     | Golf Club  | Sports facilities (tennis court, cricket ground, golf course) |   |                   |
| Support and network; administration             | School   | NBN   |   |                   |
|   |  | Soldiers Memorial Park  |   |                   |



As highlighted in Table 3, the human capital and social capitals were identified to be the strongest in Tarnagulla due to highly skilled individuals and a great sense of community that would allow for collective action. The town is also comprised of many historic buildings (physical capital), which many felt proud of and emotionally connected to (Figure 8). However, the Figure 7 and Table 3 highlight sparse economic capital. The remnants of gold mining, now under management status, Ironbark bush, a drought tolerant tree and biking tracks were identified as natural capital (Figure 9).



Tarnagulla Post Office  
(Credit: Paul Davis)



Tarnagulla Public Hall and Community Centre  
(Credit: Author)

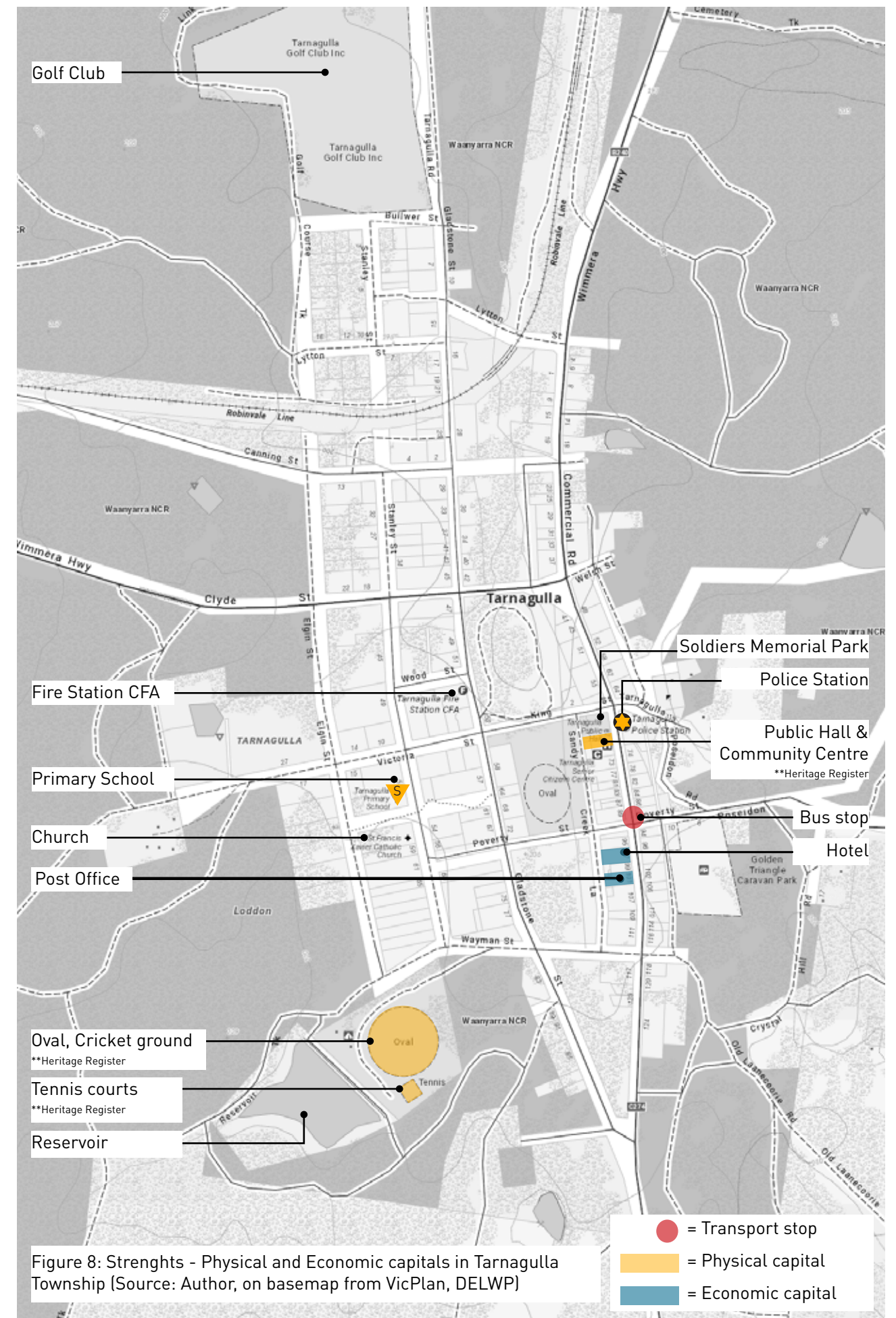


Figure 8: Strengths - Physical and Economic capitals in Tarnagulla Township (Source: Author, on basemap from VicPlan, DELWP)

- = Transport stop
- = Physical capital
- = Economic capital



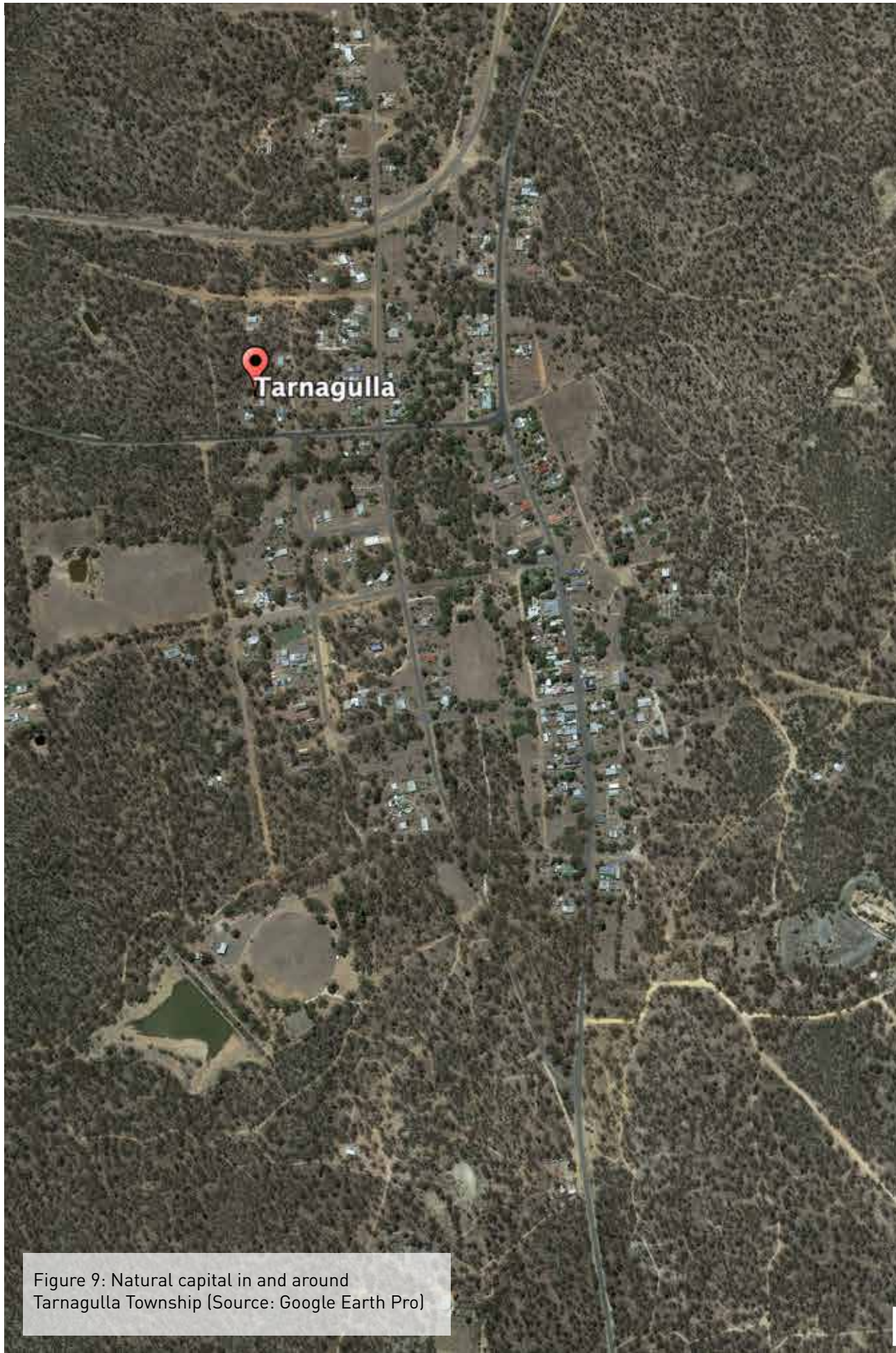


Figure 9: Natural capital in and around Tarnagulla Township (Source: Google Earth Pro)



Tarnagulla workshop participants (Credit: Mittul Vahanvati)



Participants engaged in workshop in Tarnagulla (Credit: Mittul Vahanvati)



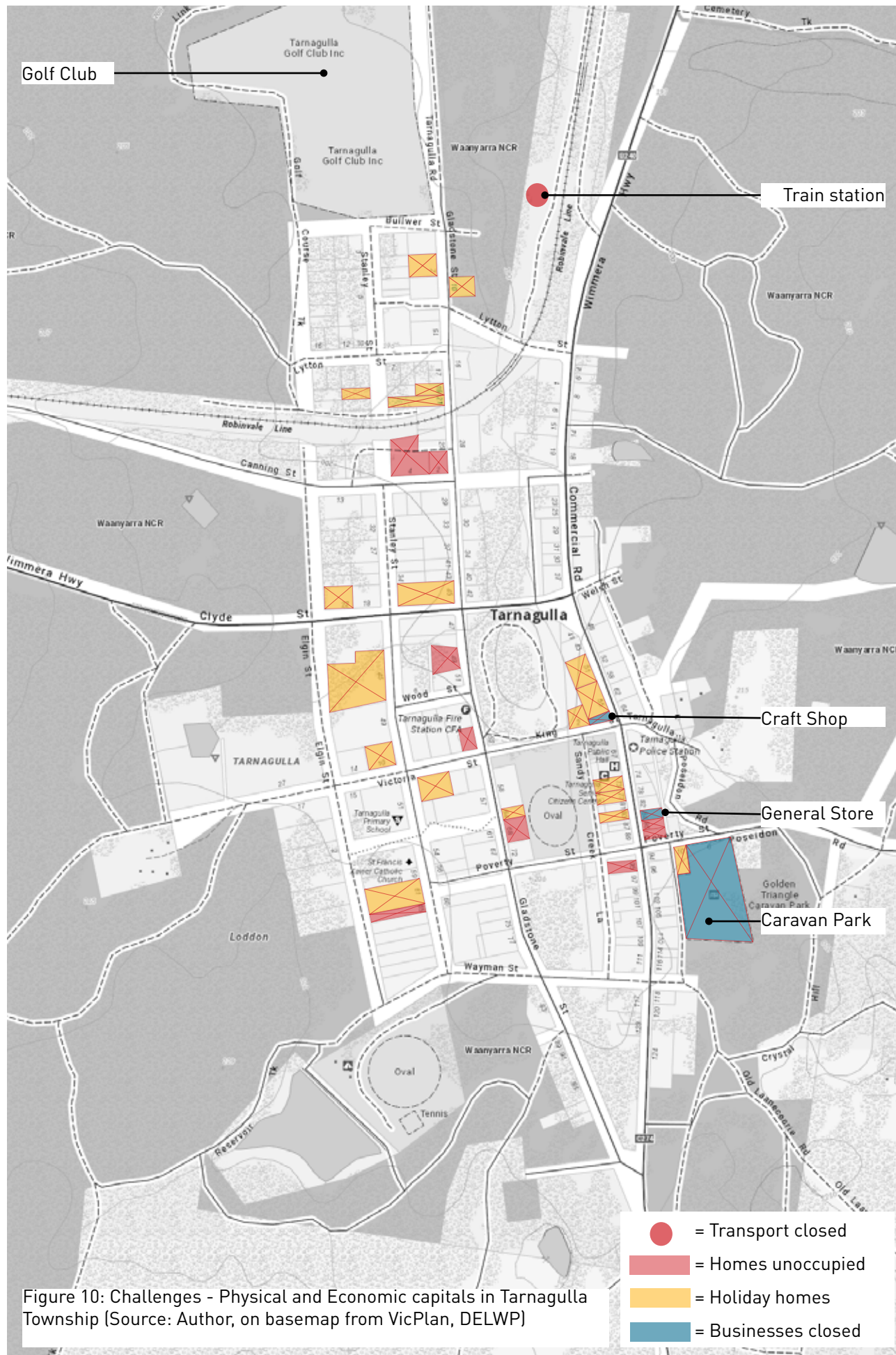


Figure 10: Challenges - Physical and Economic capitals in Tarnagulla Township (Source: Author, on basemap from VicPlan, DELWP)

## 6.2 General challenges facing Tarnagulla

The Tarnagulla community identified two types of challenges general or developmental challenges and hazard or climate related challenges.

Some of the general challenges were identified in demographic information illustrated in infographics (Figure 13 on page 29), and others rooted in developmental issues. Some of these challenges that have accumulated over time, include:

### Physical capital

- deteriorating homes, footpaths and unoccupied houses (>30%), (Figure 10)
- limited access to health care facilities
- insecure power and water infrastructure
- limited things to do in town, especially for children
- lack of attraction of town



Example of a Tarnagulla house, deteriorating and requiring retrofitting climate change adaptation (Credit: Mittul Vahanvati)





Tarnagulla business closure  
(Credit: Linda Jungwirth)



Another business closure  
(Credit: Linda Jungwirth)

**Economic capital**

- Decrease in local business
- Limited local employment with only approximately 40% of population having full-time employment; approximately 35% have part-time job and 33% of population being occupied in providing care
- Spatial disadvantage: the town does not attract people or jobs as it is not on route to any attractions
- Median weekly household income is \$706 (ABS, 2016)

**Natural capital**

- Stressed flora and fauna from increasingly hotter and drier climate causing regular pest infestations (e.g. caterpillar, locust etc.), which may make bush recovery challenging

**Social capital**

- Limited connection between many community organisations or groups



Stressed flora, Tarnagulla  
(Credit: Mittul Vahanvati)



Human capital

- Aging and decreasing population, median age is 61 years (ABS, 2016)
- 72 children in early 1900s, now very few (participant)
- A general society change where younger generation leave and do not often return

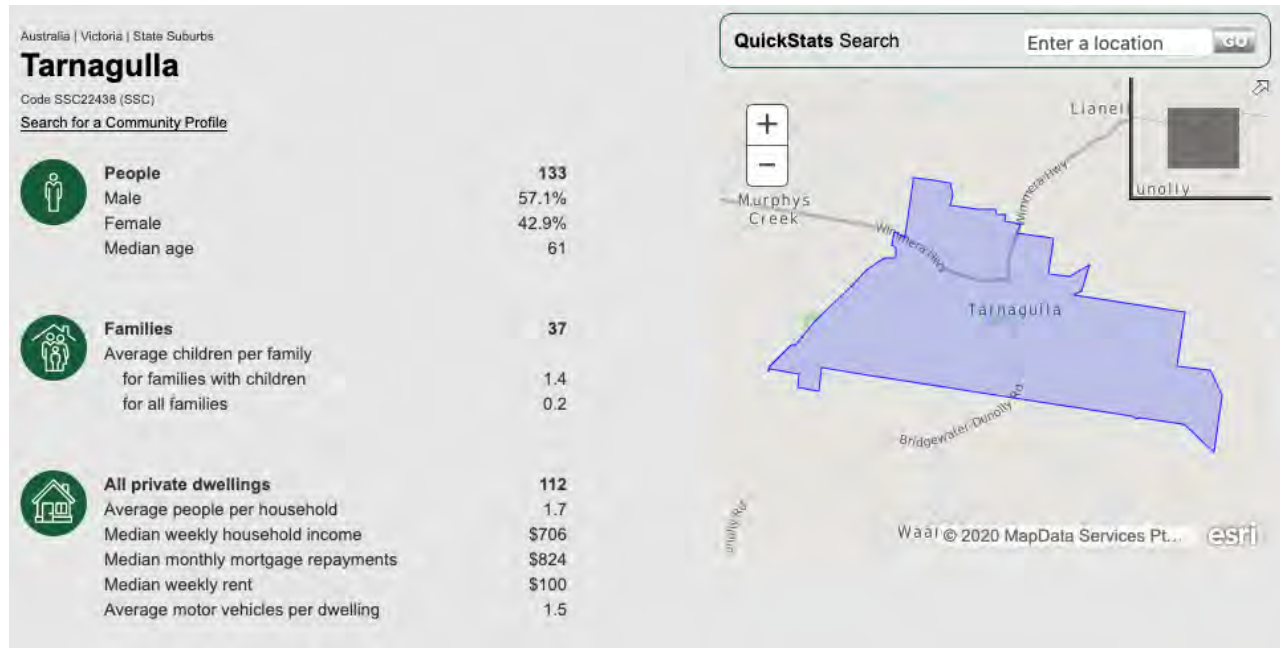


Figure 11: Census Quickstats for Tarnagulla (Source: Australian Bureau of Statistics, 2016)

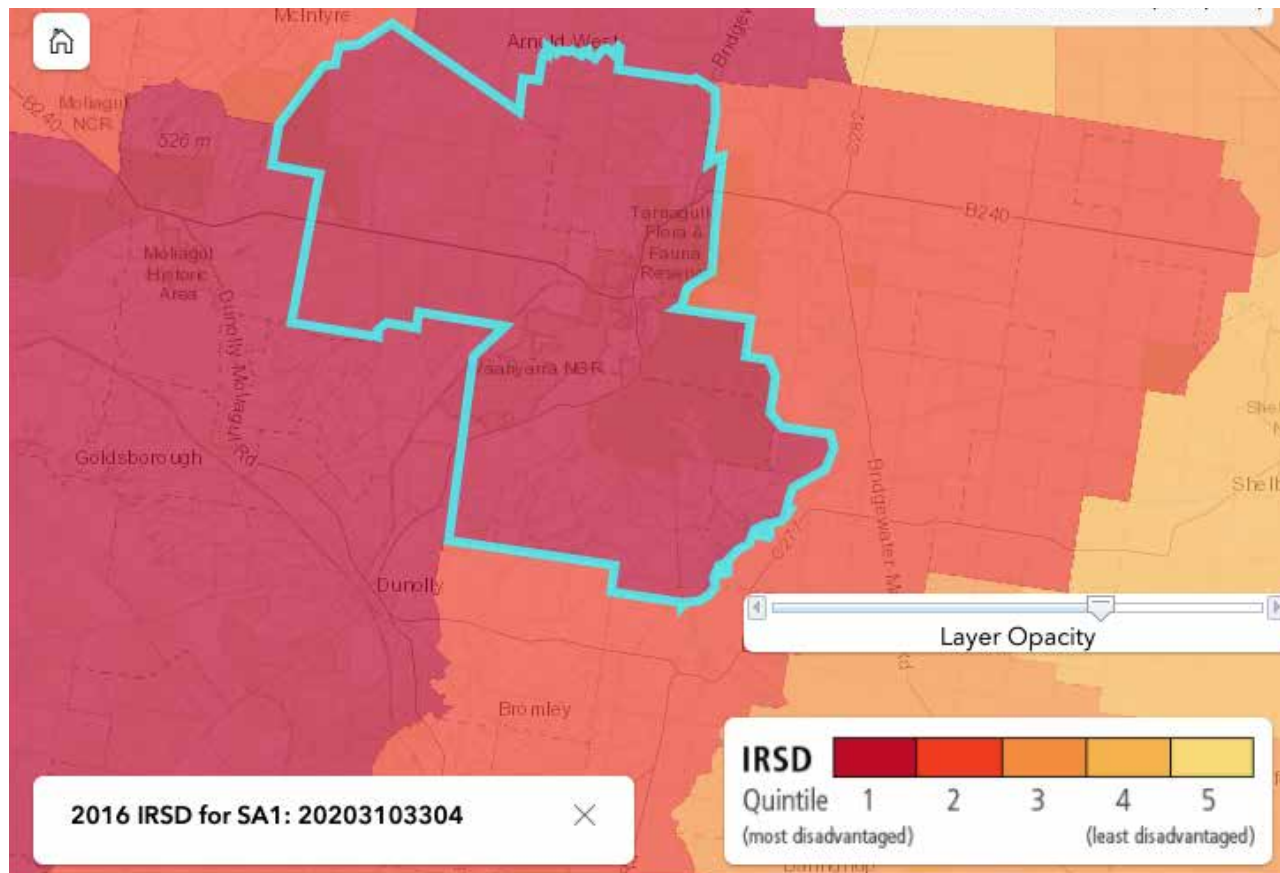


Figure 12: The Index of relative socio-economic disadvantage score (Source: Australian Bureau of Statistics, 2016)

“Our physical and economic capitals need the most attention as they are at high risk. The natural capital is also at risk from future climate uncertainties and increasing hazard risk”  
- Workshop participant

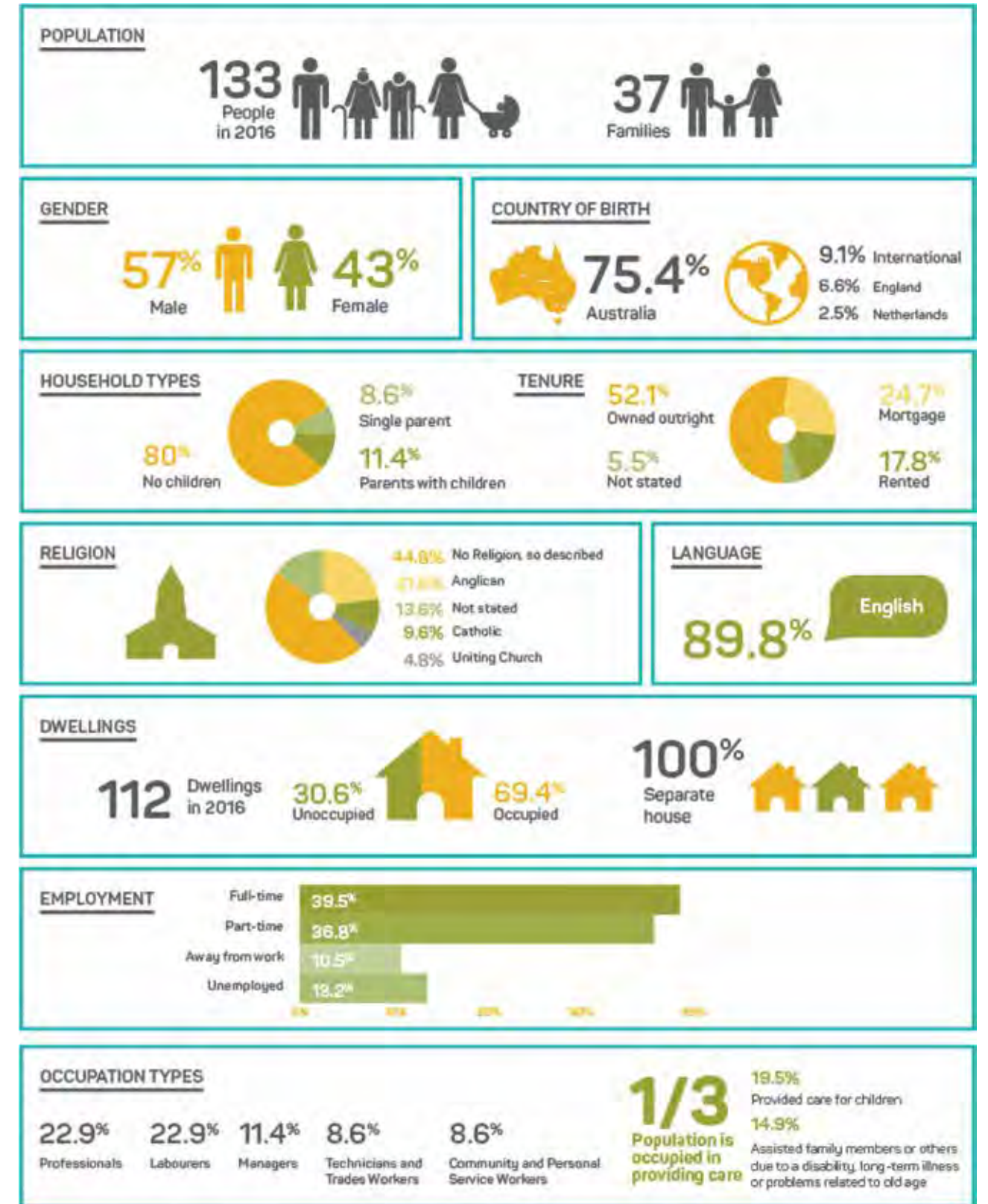


Figure 13: Infographic about demographics on general challenges facing Tarnagulla community (Source: Author, adapted from Vahanvati 2020)





Tarnagulla RAP workshop (Credit: Mittul Vahanvati)



Participants discussing items at Tarnagulla RAP workshop (Credit: Carmen Scull)

### 6.3 Vulnerability assessment to climate-related challenges

Although there is clarity in terms of the general trajectory of a warmer and drier climate, precisely how they will manifest in specific towns, is rather unclear. This is because climate change is complex and difficult to predict. Moreover, as a society, we neither have control over the situation nor know what specific actions need to be taken to adapt.

The only hope is in identifying underlying root causes of vulnerabilities. To do so, we first develop an understanding of vulnerability concept through its framework, and then understand the components of vulnerability (Figure 14).

#### Vulnerability framework

Vulnerability is defined as “the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards” (UNISDR, 2017). Vulnerability is thus determined by:

1. Sensitivity or susceptibility of people, places and assets,
2. Exposure to hazards and climate-related extreme weather events and
3. Lack of adaptive capacity or ‘capacity deficit’ (Handmer, 2003, McEvoy et al., 2013)

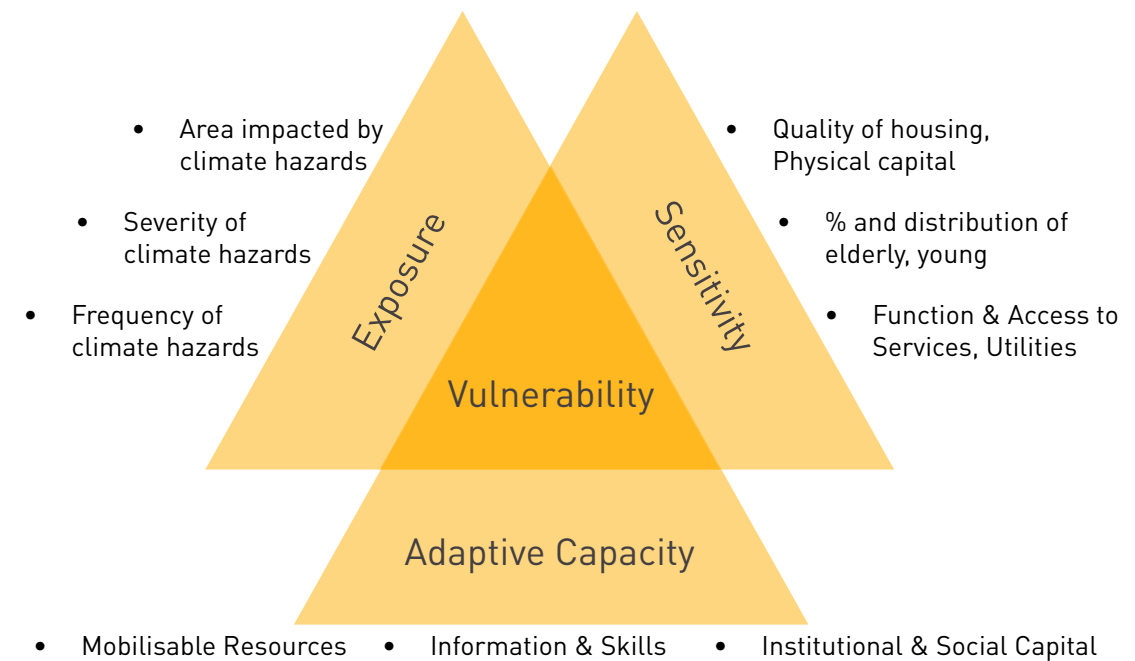


Figure 14: Components of vulnerability (Source: Adapted from UN-Habitat, 2016)

#### Exposure and climate scenarios

The whole of Tarnagulla is exposed to heat waves, bushfire, drought and tornadoes (Figure 15). Since these current exposures are not the best gauge for what the town will be exposed to in future, we compared the scientific data with the town’s historic and present day observed trends (Table 4). The scientific data on climate change projections was derived from the Victorian State Government, CSIRO research and the Climate Institute (Clarke et al., 2019); Northern Victorian Emergency Management cluster,(NVEM Cluster, 2018), Emergency Management Victoria (EMV, 2016) and Loddon Shire Council (Table 4).



Table 4: Climate change projections and its impacts (Source: DELWP, 2015, NCCMA and Water Technology Pty Ltd, 2014, NVEM Cluster, 2018, Clarke et al., 2019, EMV, 2016)

| Historic trends                         |   | Climate Change projections  | Impacts  |
|---|---|---|--|
| Community observations                  | Regional data   |   |  |
| Heat waves > 40C days                   | Av. temperatures increased by 1.2°C-1.4°C in the Loddon shire, since 1950 | Annual av. temperature increase by 1°C (2030) and 1.6°C -2.7°C (2070)                           | <ul style="list-style-type: none"> <li>Power outages getting longer and more frequent</li> <li>Increase in cost of cooling house</li> </ul>  |
|   | Current av. No. of hot days >35°C = 13 days                               | Median of days >38°C is 4.2 for 1981-2010<br>Median of 5.7-15.7 for 2040-2059                   |  |
| 1962 Hotel fire                         | Harsher, longer and more frequent fire season                             | Catastrophic bushfire risk may occur every 2.4 years instead of once in every 33 years, by 2050 | <ul style="list-style-type: none"> <li>Post- 1962/65 fires, some loss of life; Dining area and facade rebuilt</li> <li>A few people did not recover psycho-emotionally after the fires in year 2000</li> <li>Junior Fire Brigade opened in year 1985 (no more operating);</li> <li>CFA resurgence</li> </ul> |
| 1965 Major fire                         |   |   |  |
| 2000 Church fire                        |   |   |  |
| 2010 floods were (1/100 years flooding) | Rainfall reduced by 0-100 mm, and by 100-200 mm in the region, since 1950 | Av. rainfall reduction by 18% (by 2030) and 23% to 30% (by 2070)                                | <ul style="list-style-type: none"> <li>Concerns about dam bursting and houses flooding after 2010</li> <li>No water for five days and no potable water for three three weeks in 2010; people had to buy water</li> </ul>   |
| 2011 floods                             | 2011 rainfall (204 mm)  | Intense and more frequent rainfall  |  |
| 1982 – 1991 drought (9 years long)      | 1996 – 2009 (13 years long) the region’s harshest Millennium Drought      | Longer and frequent droughts  | <ul style="list-style-type: none"> <li>Challenges with water and farming</li> <li>Caterpillar infestation (2013-14) challenging flora-fauna recovery ability</li> </ul>  |

Climate change risk clusters were derived by the Tarnagulla community including heatwaves, bushfires, drought and floods, as illustrated in Figure 15.

Three future climate scenarios were developed by the Tarnagulla community, based on their consideration of the risk profile of each climate hazard. Two of the three scenarios were tough/ dire while the third was desired. One of the scenarios, heat wave followed by the cascading effects of power cuts showed the inability for the elderly to cool themselves due to limited access to water was identified as the highest risk scenario. Bush fires followed by drought were identified to be second highest risk scenario. The community also considered floods and tornadoes as potential risks. Table 5 summarises the flow-on effects – primary impacts and secondary impacts – as drawn out by the community.

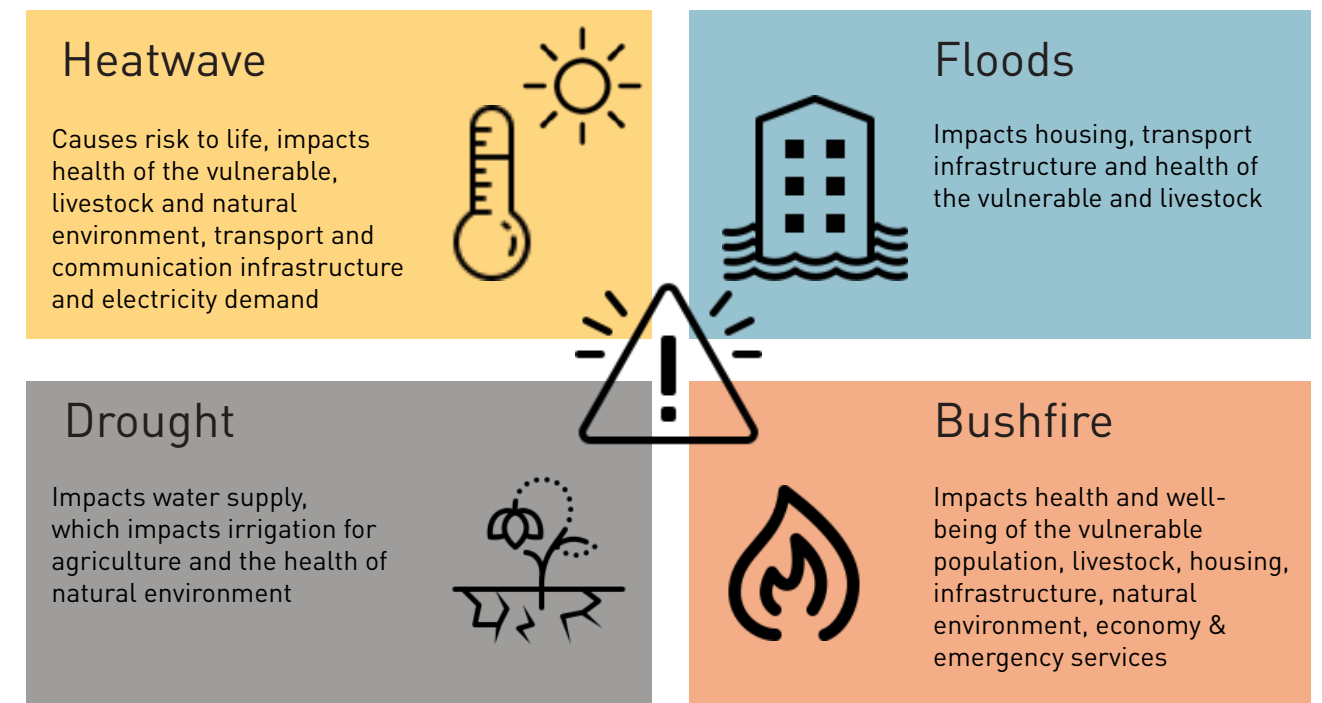


Figure 15: Climate change and hazards risk cluster for Tarnagulla and community (Source: Author)

Table 5: Three probable climate scenarios for Tarnagulla drawn by Tarnagulla community (Source: Author)

| Potential Climate Scenario | Primary impacts  | Secondary impacts   |
|----------------------------|--|---|
| Scenario 1 (highly likely) | Heat wave  | <ul style="list-style-type: none"> <li>Death of vulnerable people, livestock</li> <li>Increase in disease and health decline</li> <li>Natural environment in stress</li> </ul>  |
|                            |  | <ul style="list-style-type: none"> <li>Local economy disruption and increase in cost of living especially in primary production</li> <li>Power outages</li> <li>Health care system in stress; decline in mental health from isolation due to disruption in transport and communication</li> <li>Potable water and food shortage</li> <li>Pest infestations causing tree recovery challenging</li> </ul> |
| Scenario 2 (likely)        | Extended drought and Fire                                    | <ul style="list-style-type: none"> <li>Insufficient water</li> <li>Inadequate water for irrigation for agriculture</li> </ul>   |
|                            |  | <ul style="list-style-type: none"> <li>Same as above</li> <li>Housing and infrastructure destruction (e.g. roads)</li> <li>Psychological impact</li> </ul>  |
| Scenario 3 (desired)       | All of the above, but resilient community living with change | <ul style="list-style-type: none"> <li>Cohesive community, continuously learning</li> <li>Robust homes &amp; infrastructure</li> <li>Thriving economy, Drought proof farms</li> <li>Renewable energy</li> </ul>   |
|                            |  | <ul style="list-style-type: none"> <li>Resilient community</li> <li>Positive outlook of Tarnagulla town; celebrating strengths within the town</li> <li>Gain political voice</li> <li>Innovation in economic activity and livelihood</li> <li>Self-sufficiency for power</li> </ul>   |

### Sensitivity

While the whole town is exposed to identified hazard risk clusters, the people and assets most sensitive to its impacts varied, as outlined in Table 6.



Table 6: Three probable climate scenarios for Tarnagulla drawn by the Tarnagulla community (Source: Author)

| Capital forms     | Vulnerable people, places and institutions in Tarnagulla   |
|-------------------|--|
| Human capital     | <ul style="list-style-type: none"> <li>Elderly (over 65 years old) 43.8 % of population</li> <li>Children (0-14 years old) 7.4 % of population</li> <li>Low income households (42.9%) with less than \$650 gross weekly income</li> </ul>  |
| Social capital    | <ul style="list-style-type: none"> <li>CFA future</li> <li>Police future</li> <li>Many community groups but work in silo</li> </ul>  |
| Economic capital  | <ul style="list-style-type: none"> <li>Agriculture or Primary productions and animal industries</li> <li>Downturn in local businesses</li> <li>Economic stress of maintaining houses, most with heritage value (median house price =\$175,499, decreasing with a warming climate)</li> </ul>   |
| Physical capital  | <ul style="list-style-type: none"> <li>Deteriorating and climate mal-adapted houses, unsafe in bushfires or hot weather (especially unoccupied or holiday homes = &gt;30%)</li> <li>Unreliable infrastructure (e.g. cracked and rutting roads)</li> <li>Stressed health care system</li> <li>Insecure services (e.g. water and energy)</li> <li>No emergency shelter or evacuation plan (Community hall can act as one)</li> <li>Limited recreational options for children e.g. playgrounds</li> </ul> |
| Natural capital   | <ul style="list-style-type: none"> <li>Damage to environmental sites e.g. reservoir</li> <li>Stressed flora-fauna e.g. early flowering, pest infestation</li> <li>Erosion from floods</li> <li>Pest infestations</li> </ul>  |
| Political capital | <ul style="list-style-type: none"> <li>Limited political willingness to allocate resources for climate change adaptation</li> </ul>  |

### Capacities to adapt to uncertain future(s)

Capacity is defined as “the combination of all the strengths, attributes and resources available within an organisation, community or society to manage and reduce disaster risks and strengthen resilience” (UNISDR, 2017, u.d.). While the Tarnagulla community has already identified their strengths in the form of five capital forms in general circumstances, they have not assessed their qualities and attributes. As per IFRC (2012) community resilience framework, it is the capacities and the qualities of each capital form, which determines the resilience of communities and system.

Qualities of capital forms include robustness, well-located housing and physical infrastructure, equitability and resourcefulness in economic capital, diversity (social and natural capitals), ability to learn and adapt to a changing future (human capital) and redundancy (Table 7).

Table 7: Assessment of adaptive capacities (Source: Author, informed by UN-Habitat, 2014) Red shows high risk due to lack of capacity and yellow shows moderate capacity.

| Human capital (individual skills and capacity)  | Yes/ No/ Maybe | Description of why such answer  |
|---|----------------|---|
| Awareness of a) climate change and b) potential impacts/ risks in your area?  | Yes            | We live with and witness climate change impacts   |
| Have you applied your skills to address or respond to climate hazard/ impacts?  | Yes            | Fires, floods etc.  |
| Have you undertaken skills training or workshop to learn about ways to address/ mitigate climate change impacts?  | Yes            | Permaculture, food swap etc.  |
| Are there trained emergency response/ management teams in your town?  | Yes            | CFA, Senior citizens  |
| Is there an ability to communicate with all affected people in town during an extreme event (e.g. evacuation plan, a designated key point of contact, basic radio and regular interaction etc.) | Maybe          | <ul style="list-style-type: none"> <li>½ hr to do door knocking</li> <li>No Evacuation Plan</li> <li>Not everyone has radios, and mobile phones run out of battery if no power</li> </ul>                     |
| Are local stakeholders aware of risks from climate change?  | Yes            | Farmers are already diversifying their income source  |
| Social capital (collective capacity)  | Yes/ No/ Maybe | Description of why such answer  |
| Is there diversity and cohesion in community?   | Maybe          | Limited diversity and lack of cohesion  |
| Have you coped well with past extreme weather events?   | Yes            | <ul style="list-style-type: none"> <li>1964 Tornado, 1965 fires;</li> <li>1980-1991 drought;</li> <li>2000 church fire; 1/100 yrs);</li> <li>2011 floods;</li> <li>2013-14 Caterpillar infestation</li> </ul> |
| Are there notable community/neighbourhood “leaders” that can quickly organize people in the event of extreme weather event?   | Yes            | Longstanding eldest citizens, CFA, Parks and recreation group, Neighbourhood watch, Cemetery trust  |
| Are there any specific agencies, community groups and/or NGOs that have the mandate and skills to support Tarnagulla’s climate resilience?  | Yes            | DELWP, EMV, TAEG, CVGA  |
| Is there political willingness to allocate resources to build adaptive capacity?  | Maybe          | State government funding; but no support from local Council for climate resilience; federal electoral boundary changed recently   |
| Economic capital  | Yes/ No/ Maybe | Description of why such answer  |
| Do you have access to adequate financial resources and funding?   | No             | Approx. 60-70% people live from pension to pension  |
| Have you managed to diversify your livelihood to meet the needs of a changing climate?  | Yes            | Many people have diversified livelihood e.g. bed and breakfast, farming pigs + sheep; full time job + other jobs  |
| Do you have resources to respond to a climate related hazard or extreme weather event (e.g. access to basic transportation, adequate ration, ability to relocate temporarily, basic shelter)?   | No             | Yes, but would need external support (financial, logistical)  |
| Do you have adequate time to plan and implement adaptation actions?   | Yes            |   |



| Physical capital   | Yes/ No / Maybe | Description of why such answer  |
|--|-----------------|---|
| Is your house robust to withstand extreme weather events?                          | No              | Various housing from Federation (1860s), that are not built for fires or tornadoes; House insurance high  |
| Is there adequate transport?   | No              | Bus to Bendigo only once/week<br>Bus to Adelaide<br>Community bus in Inglewood and Maryborough, but not Tarnagulla  |
| Is there adequate water infrastructure?  | No              | Current piped water is from Laanecoorie and gravity fed; maybe in 2-3 years we may be connected to the Wimmera Mallee Pipeline  |
| Is there adequate energy supply and management?                                    | No              | Too many power outages  |
| Is there adequate sanitation and sewage system?                                    | Yes             | Septic tanks – that is only economically feasible solution  |
| Are major infrastructure and/or facilities located in hazard-safe area?            | No              | NBN tower, Telstra tower  |
| Are there adequate medical services in proximity?                                  | No              | <ul style="list-style-type: none"> <li>• Nearest hospital is 15km away in Dunolly, otherwise 23km to Inglewood or 46km to Bendigo Base Hospital or St John of God.</li> <li>• Ambulance can take up to 45 mins to arrive from Inglewood</li> <li>• Have defibrillator at the Public Hall</li> </ul> |
| Did you manage to retain access to clean, drinking water in the event of a hazard? | Yes             | Many people have rainwater tanks  |
| Natural capital  | Yes/ No / Maybe | Description of why such answer  |
| Is local vegetation drought and heat tolerant?                                     | Yes             | One Grevillia species is drought tolerant   |
| Is local bush fire resistant?  | Yes             | Local vegetation not prone to many ember attacks  |
| Has local flora coped with pest infestations?                                      | Maybe           | <ul style="list-style-type: none"> <li>• Trees recovered after 2 seasons of no leaves from 2013-14 caterpillar infestation; but if such infestations happened for longer the trees may not recover</li> <li>• Locust infestation (every 5-10 years)</li> </ul>                                      |

As highlighted in Table 7, the physical capital (housing, transport, energy and water infrastructure and health care facilities) has the least capacity to cope with a changing climate and weather extremities followed by the economic capital (local livelihood, funding) and human capital (aging population), in Tarnagulla. The social and natural capitals have the strongest capacity to cope with uncertainties in Tarnagulla. However, community cohesion among varied community groups was identified as a missing element in Tarnagulla’s social capital, which is essential to have a strong political voice and carry influence.

## 7. Phase 3: Resilience action planning

The Three Horizons chart developed by the International Futures Forum (IFF, u.d.) was used to assist the Tarnagulla community to carve a pathway from the present to desired future(s). The Three Horizons approach was found useful to understand the seeds of three different future scenarios, visible in present times. This approach emphasizes systems thinking and observing activities in the form of patterns to understand how their interactions might play out over time.

Note that the Horizons are described in order of first, third and then second. The reason being, H1 relates to the present and H3 to the future we aspire, while H2 relates to a transition from H1 to H3.

**The First Horizon (Red)** – H1 is the dominant system at present. It represents ‘business as usual’, with characteristics of being a stable and reliable system. However, as the world changes, some aspects of business as usual begin to feel out of place or no longer fit for purpose (Figure 16).

**Third Horizon (Blue)** – H3 relates to a radically different future than the present dominant H1 and one which is much better fitted to the world that is emerging. H3 can be related to the long-term vision developed by the Tarnagulla community. Traces of H3 maybe present but only as fringe activities.

**Second Horizon (Yellow)** – H2 relates to the process of transitioning from H1 to H3 over time. Identification of activities and innovations will help develop RAP that will help the Tarnagulla community to eventually supersede business as usual with new ways of doing things.

This section discusses the outputs from co-production workshops on H1, H2 and H3, followed by bringing the deeper understanding gained so far of the Tarnagulla community’s strengths, challenges and potential opportunities (H1,H2 and H3) – together (Table 8).

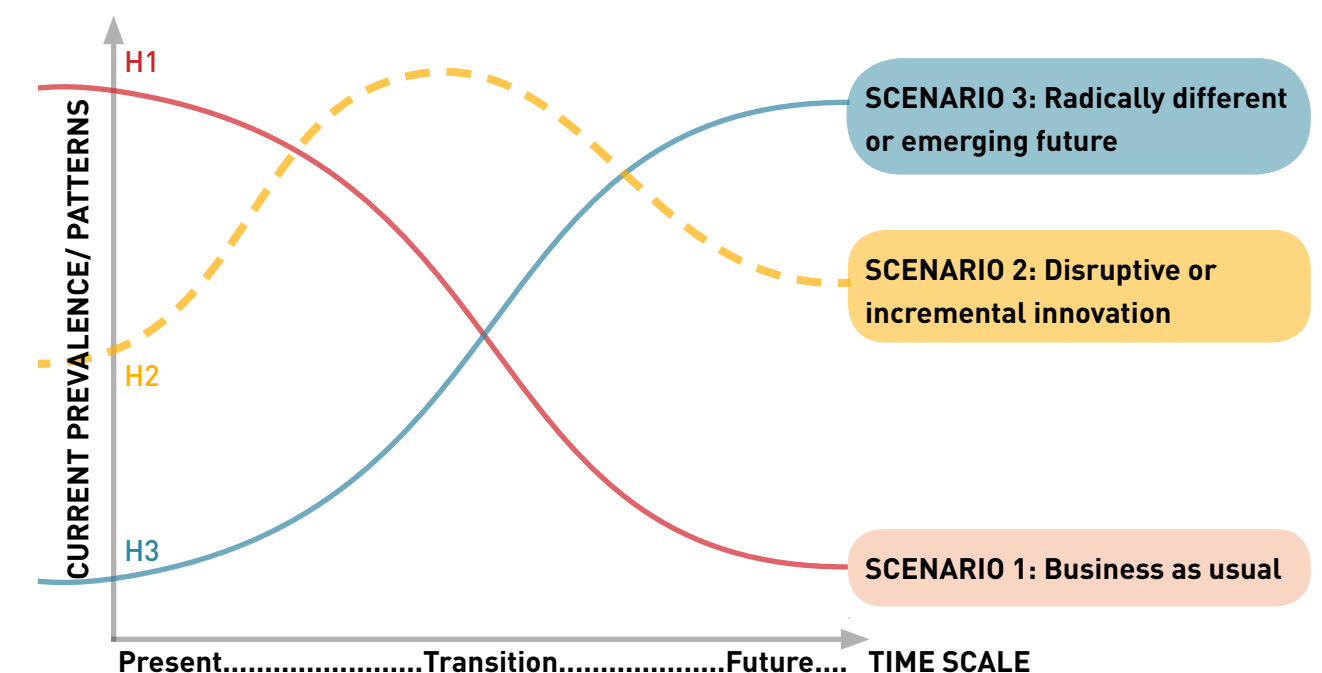


Figure 16: The Three Horizons approach developed by the International Futures Forum (IFF) Institute



## 7.1 Horizon 1: What is the dominant system?

The first Horizon concerns the present dominant system or the way in which the patterns from a systems perspective have helped or hindered the Tarnagulla town's ability to respond to change and to adapt.

The first of two workshops conducted was based on a historic timeline and the second, was a reflection on questions related to Horizon 1. The historic timeline workshop was found useful for the Tarnagulla community to identify patterns in relation to past climate extreme events – what worked, what did not, and what experiences shaped the current day Tarnagulla. It also helped understand what would constrain or enhance the community's future efforts by recognising embedded local knowledge.

Based on an understanding of historical evolution of system, the Tarnagulla community reflected on their concerns, values and what they wished to retain, by answering some of the following questions related to Horizon 1:

- What is business as usual? What are its characteristics?
- What events or values led us to the present?
- Why do we feel it is not fit for purpose/ what's broken/ not working – give examples of what is failing? Where does resistance to change exist within system?
- What's worth keeping (or valuable) from the present?



Participants engaged in Historic timeline workshop (Credit: Sitong Wei)

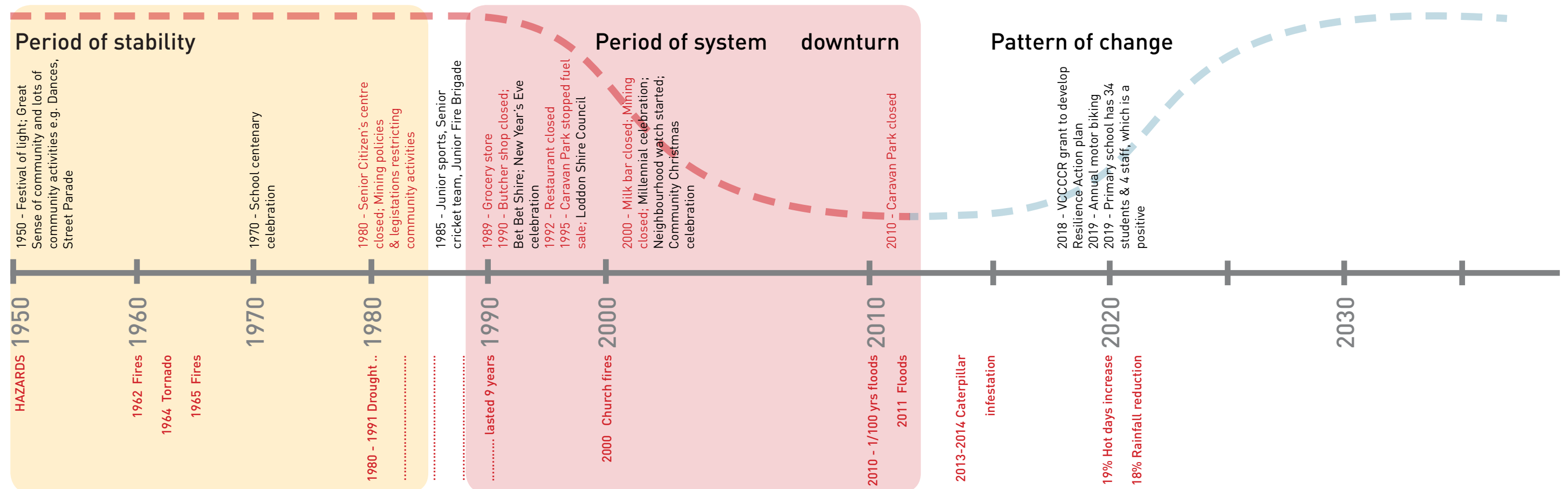


Figure 17: Systemic patterns in Tarnagulla from historic timeline workshop (Source: Author)



Patterns that emerged from the historic timeline workshop are as follows (Figure 17):

- **Periods of stability** associated with a great sense of community (early 1980s to 1990s) and many community activities like fireman's ball, sports, junior fire brigade, progress society, New Year's Eve celebration, and millennial celebration
- **Periods of system downturn** associated with the fires of 2000 (35 years after the previous significant fire), built upon 9 year long drought
- **Conditions leading up to the feeling of downturn** associated with:
  - Mining going into maintenance in 2010, as retrieval too expensive
  - Economic downturn – closure of the local butcher shop, grocery store, the caravan park (stopped selling fuel and then got sold)
  - Policies and regulations, such as, owner's occupation that led to closure of many local businesses; paid parental leave that encouraged working women due to increasing cost of living (e.g. interest rate increase); introduction of speed limits led to closure of biking
  - Growing concern of climate-related hazards or extreme weather events
  - Reduction in community spirit and freedom of activities in public space (e.g. could not do fireworks in public); and many people leaving town
- **Reflections on what did not work** during emergency and recovery?
  - Limited psychological and emotional recovery post July 2000 fires at the Wesleyan Methodist Church, as it took the life of a valued community member - a fireman
  - Loss of economic activity and social amenity (e.g. golf club) not helpful
  - Limited support from the local Council for climate resilience projects (note: developmental projects are supported)
- **Reflections on what worked** during emergency and recovery?
  - Support from emergency services (CFA, 2017, EMV, 2016) post 2000 fires
  - Resurgence in local businesses e.g. Golf club
  - Support from the local Council for development works and emergency efforts
- **Most valued things** that the community identified and wished to retain while planning for future were:
  - Social capital: Community spirit and activities (active socialising), already returning; CFA progression and resurgence; School (has 34 students which is positive)
  - Natural capital: Feeling of peace and quiet; Reservoir; Nature conservation
  - Economic capital: Local businesses such as Recreational Reserve Camp Ground, Bed and breakfast, Coffee shop, Pub and Golf club resurgence
  - Physical capital: Heritage look of houses but needs renovation to make the town attractive to tourists

The historic timeline process revealed for the Tarnagulla community that they were resilient and in control of their future, during past disasters or disruptions, when their community spirit and freedom was high, which, in-turn was reliant on the local economy as well as the local Council hearing their collective concerns. The capital forms they valued and wished to retain (i.e. social, physical and economic), as it helped them during past emergencies and recovery, aligned with the capital forms they prioritised during resilience concept definition.

## 7.2 Horizon 3: Long-term vision for Tarnagulla

The future that the Tarnagulla community wish to have was defined as being resilient under section 5.2, which can be reiterated as:

“The Tarnagulla community of the future will be different. Together we will work towards developing and sustaining a thriving town. We will have a strong social culture built on a diverse and connected population representing and welcoming peoples of all ages, status, ethnicities and interests. We will have a beautiful town with a sustainable economy built on local agriculture, businesses, clubs, organisations and tourism. To be resilient we will have developed the necessary capabilities to confidently address our future.”

The vision highlights that retaining and strengthening a sense of community is of utmost importance to the Tarnagulla community. A few community members said, “we want to attract more people and businesses to town and stabilise the town from further decline”. While social capital forms the foundation for future, it also relies on a thriving local economy and physical infrastructure.

**Seeds of such visionary future(s) visible in the present** activities or groups include:

- Work of community groups such as, Tarnagulla Action Group, Tarnagulla Alternative Energy Group, the Loddon Southern Region Development and Tourism Committee and the Golf club
- Work of the local Council in terms of education and awareness about climate change
- Increase in economic activity: Bed and breakfast are thriving, the Community Centre's coffee shop has been leased and is now open, the new history archive has also opened
- Return of community-minded residents to the town
- Investment by many residents in solar panels, upskilling for adaptive response as well as change in mindset e.g. training in permaculture to grow vegetables that require less water and consumption of seasonal produce



Tarnagulla Country Fire Authority (CFA) members  
(Credit: Jordan Ford)



Scaling of these visionary activities or patterns would require:

- Financial resources either through Councils or grant applications
- Human resources – requires commitment from group of people to manage change
- Good communication – Social media e.g. CFA and Tarnagulla Facebook page – a closed group; via post office; Tarnagulla Newsletter
- Increasing economic activity by organising events to attract tourists to the town
- Ensure continuation of CFA, Reservoir, Camping and School

## 7.3 Horizon 2: Disruptive or Incremental innovation

To understand how the Tarnagulla community can transition from the current dominant paradigm (H1) to desired future(s) (H3), their strengths, challenges, vulnerabilities and capacities are brought together in form of a matrix (Table 8).

Table 8: The Three Horizons approach to mapping activities from the current dominant paradigm or Horizon 1 to Horizon 3 via Horizon 2 (Source: Author)

| Capital forms           | Horizon 1: Present dominant system   | Horizon 2 - Transition activities                            | Horizon 3 -Vision for the future  |
|-------------------------|--|--|---|
| <b>Human capital</b>    | Vulnerable population (elderly; children and low-income group)   | Support and care for each other                              |   |
|                         | Decrease in population   | Introduce more community diversity (welcome refugees)        | Attract people to live in and visit Tarnagulla                                      |
|                         | Limited knowledge or awareness of climate change, vulnerability and adaptation                             | Environmental educational programs causing change in mindset | People knowledgeable and able to plan for climate change                            |
|                         | Limited communication skills and capacity e.g. during emergencies  | Better communication via social media, within + outside town | Clear communication plan for emergencies; further develop skills at sharing of data |
|                         | People happy   |  |   |
|                         | Skilled in management, making, land-care, local history, health and permaculture                           |  |   |
|                         | Capacity to respond to climate change related extreme events or hazards                                    |  |   |
| <b>Social capital</b>   | Multiple committees but work in silo   | Merge all groups   | Ability to take collective action and share skills                                  |
|                         | Decline in 'active' CFA members who fight fires and the Police staff                                       | Promote active participation                                 |   |
|                         | Community spirit resurgence (worth retaining)  |  |   |
| <b>Economic capital</b> | Farming and primary production-based businesses at high risk   | External support for climate adaptation                      | Heat and drought tolerant farming   |
|                         | Local business downturn  | Support festivals  | Thriving and diversified local economy  |
|                         | Increasing cost of commute due to distant work and increase in fuel cost                                   | Develop solar farm or biofuel                                | Build adequate financial capital (internal + with external support)                 |
|                         | Low income households with inadequate financial resource as 1/3rd of population occupied in providing care | Facelift shops and businesses                                | Make town attractive for businesses   |
|                         | Low cost of land   |  |   |
|                         | Bed and Breakfast started and thriving   |  |   |

| Capital forms                | Horizon 1: Present dominant system  | Horizon 2 - Transition activities   | Horizon 3 -Vision for the future   |
|------------------------------|---|---|--|
| <b>Physical capital</b>      | Unoccupied and deteriorating homes  | Retrofit and facelift housing, infrastructure, and services   | Climate resilient and adaptable housing and infrastructure, including renewable energy |
|                              | Deteriorating infrastructure e.g. footpaths, water, energy and transport  |   |  |
|                              | Inadequate health care services or social amenities for children  | Add sports facilities for children  | Better health care services and retention of school education (U3A)                    |
|                              | Lack of attraction to town (no reason to stop or visit)   | Add signages and greening of public spaces  | Town attractive to tourists  |
|                              | No emergency shelter or evacuation plan during extreme events   | Develop a clear evacuation plan, emergency shelter, a designated key point of contact, basic radio, regular interaction etc |  |
|                              | Beautiful bush and bushwalking tracks   |   |  |
| <b>Natural capital</b>       | Damage to environmental sites e.g. recreational reservoir, flora and fauna, biodiversity                              | Conservation and development of drought tolerant species e.g. Goldfields Grevillia, by Landcare group                       | Resilient environmental sites, and flora-fauna   |
|                              | Pest infestations e.g. locust infestation every 5-10 years  |   | Extend walking and bicycling tracks  |
|                              | Lack of firewood for heating (as outsiders get it before locals)  | Policing of coup for firewood collection  | Ample firewood for the locals  |
| <b>Institutional capital</b> | Limited political willingness (especially at local council level) to allocate resources for climate change adaptation | Develop good working relationship with local Council, NGOs and non-profit groups  | Community voice heard by government  |

Several actions identified by the Tarnagulla community as Horizon 2 (highlighted in yellow in Table 8), to instigate transition from H1 to H3, are:

1. Make the town safe and attractive for tourists and businesses by retrofitting and facelifting housing, infrastructure and services, adding signages in town, greening of public spaces, and have sports facilities for children and develop a clear evacuation plan, emergency shelter, a designated key point of contact, basic radio, regular interaction etc
2. Boost and diversify the local economy, support events/ festivals and tourism; facelift shops, businesses, open coffee shops and develop solar farm or biofuel and adequate external financial support for climate adaptation actions
3. Change in mindset about risk and better communication via social media, in and outside of town
4. Strengthen community cohesion by introducing more community diversity, reintroducing regular social activities, merging the range of committees/ community groups
5. Landcare group to help raise awareness, conserve and develop drought tolerant species (e.g. Goldfields Grevillia), as well as have policing of coup for firewood collection
6. Develop good working relationship with local Council, NGOs and non-profit





Participants in co-production workshop  
(Credit: Mittul Vahanvati)



Citizen jury workshop participants  
(Credit: Mittul Vahanvati)

## 7.4 Resilience Action Plan

The Tarnagulla community prioritised the actions through a citizen jury or voting based on which actions that are achievable and aligned with their vision for a resilient future. These actions, listed by priority, are as follows:



### Action 1. Facelift Tarnagulla (physical capital)

The town unanimously identified facelifting the town as essential for multiple benefits such as creating a positive vibe for locals as well as tourists and economic stimulus.

Actions required for facelifting the town include:

- Retrofitting homes to be setup for hot days, fires or tornadoes
- Facelifting main street (footpaths, shops, public toilets) (note: Commercial Road already has historic streetlights and benches)
- Risks= Need of political will to accomplish these actions

Project lead and partners = Tarnagulla community, TAEG, Community Planning Group, Loddon Shire Council



### Action 2. Boost local economy (economic capital)

Attracting tourists was identified as the main way to boost local economy. Actions identified to boost local economy are:

- Develop ideas for and promote annual event/s that showcases local uniqueness and strengths. E.g. Festival titled "Tarnagulla GOLD" to celebrate the Gold era.
- Art Trail has already joined with other local communities in 2020
- Risk = the median age of local population is 60+ and facilitating an event at scale requires physical infrastructure and basic amenities.

Project lead and partners = Tarnagulla CFA and more



### Action 3. Establish reliable sources of energy (physical and economic capital)

Having reliable sources of electricity was identified as essential for comfort and wellbeing of all, especially during heat stress or fires. Renewable energy and fuel would also reduce the cost of living. Actions include:

- Reliable power supply, ready for solar grid connection
- Underground powerlines (as has been done in Clunes)
- Risk: Requires political support and financial support



### Action 4. Strengthen community spirit (Social capital)

Actions identified for retaining and further strengthening community spirit are:

- More cohesive community; bring people together on regular basis to create common vision, consensus and care for the elderly
- Awareness raising around risk, hazards and climate change



### Action 5. Improve access to health services and public transport

Due to the median age of 60+ of local population, having access to health care services is very important. Transport infrastructure is equally important for all age groups.



## 7.5 Stakeholder scenario testing workshop

The stakeholder workshop was developed in order for the Tarnagulla community to start thinking differently about potential future risks and what they, as a collective, could do to prepare. The presence of various stakeholders allowed the community to test their priority actions against one climate scenario - heat waves - and to confirm the validity, feasibility and viability of their actions for implementation and achieving their long-term vision of being resilient.

The community selected a heat wave scenario with the cascading effects of blackouts, limited access to water and threat of bushfire. This workshop was facilitated by EMV in partnership with TAEG and RMIT. Other stakeholders in attendance were SES, CPA, health sector, DELWP, Loddon Shire Council Councillors and Police.

## 8. Discussion: Benefits of co-production approach

The aim of this project was for the RMIT researcher to work with TAEG and the Tarnagulla community to co-produce their own RAP in the context of climate change. To achieve this aim, the project asked the following research questions:

- Q1. How does the community's definition of resilience relate to those within relevant literature?
- Q2. How effective is the community resilience framework in helping communities identify, define and analyse their strengths and challenges?
- Q3. To what extent does co-production of the resilience action plan lead to community-led initiatives (and eventually actions) that theory suggests could actually 'build resilience'?

### 8.1 Tarnagulla community's definition of resilience

The Tarnagulla community's definition of resilience was compared by Vahanvati (2020) to that provided by scholars in relevant literature and by the Australian policy makers and practitioners.

A broad review of scholarship on resilience demonstrated diverse framings of resilience concept – from engineering, psychological, ecological and socio-ecological systems perspective (Vahanvati, 2020). With etymological roots in the Latin verb 'resilire', meaning 'to rebound or recoil', the concept was first used in the discipline of ecology and by 1970s, was introduced in the fields of ecology, psychology and disaster risk management. Since then, the concept had gained traction in disaster studies due to its positive connotation, evident in the Sendai Framework for Disaster Risk Reduction (SFDRR) touting "enhancing resilience" as the aim of disaster risk management policies (UNISDR, 2015).

Despite such proliferation of the concept's use, it continues to remain contentious, and at times ambiguous, lacking normative dimension and challenging to implement in practice. Consequently,

a few scholars (e.g. Folke, 2006, Smit and Wandel, 2006, Walker and Salt, 2006, Walker and Salt, 2012) have recommended clarifying – resilience to what, when, of who or what, and when – for the concept to have any practical significance in this project.

The comparison of Tarnagulla community's definition of resilience to relevant literature proves it was similar to the systems-based (considering all capital forms) definition in literature. Moreover, they have a long-term view of addressing developmental and climate-related challenges to building resilience as they understood it took time and multi-sectorial approach to implement. The study (Vahanvati, 2020) concluded that place-based communities like the Tarnagulla community were best placed to frame their resilience based on systems' understanding and lived experiences.

### 8.2 Effectiveness of community resilience framework

The conceptual framework for community resilience developed by the International Federation of Red Cross and Red Crescent Societies (IFRC, 2012) was very useful as it provided key elements for consideration, as:

- Assets: owned by the community in form of capital forms
- Capacities of people, community and institution
- Qualities of those assets

The community resilience framework by IFRC (2012) clearly suggests that a society cannot build their resilience without first meeting their basic needs. In that context, the actions identified by the Tarnagulla community make perfect sense, as they seem to be focussed on addressing general developmental challenges. Nonetheless, the framework alone was found insufficient to help



Stakeholder scenario testing workshop  
(Credit: Mittul Vahanvati)



communities identify climate scenarios and understand systemic patterns that were conducive (or hindering) adaptation.

The Three Horizons approach developed by the International Futures Forum (IFF, u.d.) and Bill Sharpe (2013), was found most appropriate. The Three Horizons approach emphasised systems thinking and helped the Tarnagulla community see activities in patterns and understand how their interactions played out over time, in terms of helping their adaptive capacities or hindering it. Through Horizon 1, 2 and 3 mapping, the Tarnagulla community gained a deeper understanding for shaping resilience actions necessary for attaining potential future trajectories.

### 8.3 Benefits of co-production of the Resilience Action Plan to community-led initiatives

The mere act of gathering community with diverse worldviews on a regular basis over the course of this project, which was facilitated by an external facilitator (RMIT researchers), has delivered multiple benefits, both anticipated and unanticipated.

As shown in figure 18, 60% of people believed that the process of co-production benefited them, while 25% had no opinion.



Draft Resilience Action Plan report launch event  
(Credit: Mittul Vahanvati)

### Anticipated benefits

Some of the anticipated benefits of a series of co-production workshops, informed by quantitative data (amount of participation) and qualitative data (anecdotes and endorsements) are discussed below.

While it was anticipated that the process would lead to development of a RAP report, the process has provided additional benefits to the participants and the Tarnagulla community.

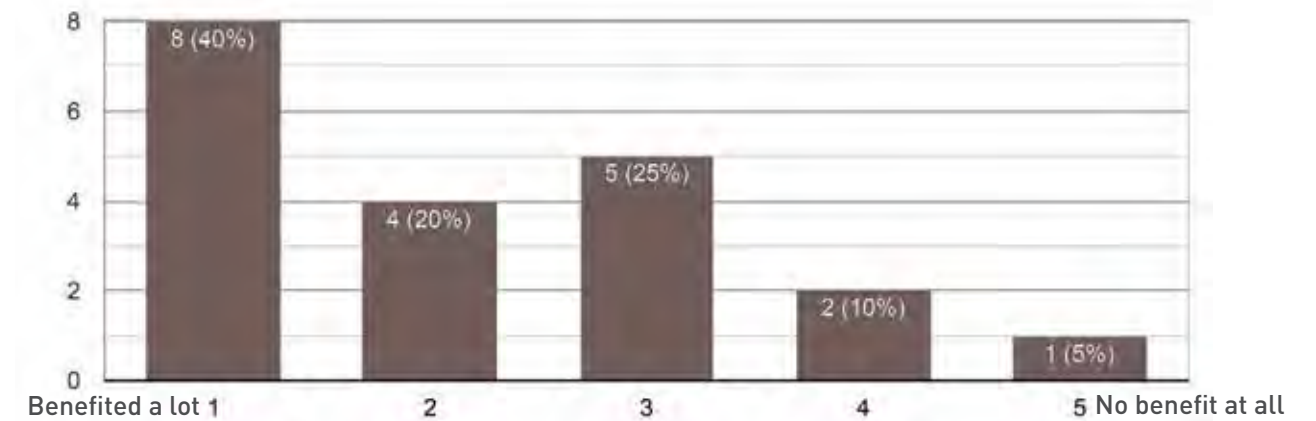


Figure 18: Survey results of community benefit from the co-production approach (Source: Author)

These benefits are as follows:

- **Stronger community** connections between PLG members, within the community and between RMIT researcher and the PLG, demonstrated in anecdotes from workshop participants:

“A stronger community spirit”

“Creating more cohesive and co-operative community”

“More trusting relationships and increased sense of community”

“Build the community spirit of the town collectively and to work towards becoming a self-sustainable town”

“I have seen people from many different groups attend the workshops that I believe would not normally come together”

“A lift in trust and confidence to share concerns, ideas and future plans. A shift in understanding away from allowing the perfect to become the enemy of the good”

“The people of the town have come closer together and realised that the challenges of the future will be best met together through common goals and strategic actions”

See Appendix for proportion of community engagement.



- **An increased awareness about climate change and resilience.**

90% of participants endorsed that the project improved their understanding of the community's strengths and challenges, and resilience and developed skills and confidence to be adaptable and resourceful (Figure 19).



Figure 19: Survey results of community rating of participating in the project (Source: Author)

Anecdotes describing the most valuable outcome from participating in this project are:

“The realisation that something needs to be done to ensure the longevity of Tarnagulla and the community’s desire to achieve that”

“Being fairly new to the town, by attending the workshops, I have gained a wealth of knowledge about our town’s strengths and met some wonderful residents whom I would not normally have the chance”

“From the workshops I now have a much greater understanding of what our town’s strengths and challenges and are making changes within our home to help combat some of the challenges we may face”

“The information in the workshops has given me a much better understanding of climate change and the effects it would have on our town as most of my prior thinking was from living in a much bigger town/city”

“I believe what is working well is the membership of the CFA is on the rise and the school is still able to operate. Community spirit is there but not enough”

“I understand more, I am aware of more options, I am more open to information and suggestions”

“Pleasant awareness of the importance of adapting to climate change”

“I have a better understanding of some of the people who live here, and am understanding more about the town itself, where it has come from, how it has developed and what it needs to do to continue to exist as a community”

- **Increased skills, sense of optimism and network**

Community members, especially the PLG, gained skills in workshop facilitation, project leadership and public speaking. The skilling up of community members will have long term benefits for the town.

Overall, there was an increased sense of optimism influenced by positive relationships, recognition and continued support by the local Council and organisations (e.g. EMV, DELWP), that were developed during the workshops.

Such heightened sense of optimism and increase in skills is reflected in following anecdotes:

“I’ve built my confidence in public speaking, hosting workshops and facilitating. The PLG work like a well-oiled machine at events”

“Identifying the needs and hopes of the community as a whole. Giving the town a ‘voice’”

“Forming relationships with organisations such as DELWP, RMIT etc”

- **Empowered community, exemplified in community-led initiatives**

Many households have already invested or are investing in generators, solar panels and ways to cool their house as preparedness for heatwaves, due to awareness gained during workshops. One participant felt that the process was “empowering in the form of inclusion.”

Community-led initiatives, with early outcomes including:

- Discussions on emergency shelter (e.g. school and community hall), evacuation plan or neutralising a crisis
- Community suggestions to lead identified resilience actions is a proof of community mobilisation, the community taking responsibility for planning and implementation of initiatives for their future

### Unanticipated benefits

We had not anticipated that this project and the co-production approach would lead to the following outcomes:

- **Revival of local economy:** Opening of a new enterprise - Tarnagulla Supply store
- **Funding bodies approaching to help:** This project and proactive climate action by TAEG influenced an outside agency, Central Victorian Greenhouse Alliance (CVGA), to choose the Tarnagulla town for an opportunity in form of a grant for a microgrid feasibility study.
- **Government approaching to help:** The Loddon Shire Council has shown interest in helping the Tarnagulla township with facelift and emergency shelter.

These benefits show the potential of community engagement in resilience projects helped stimulate community connection, inclusion and vitality. However, the challenge remains in maintaining continued motivation and to gather on a regular basis to build cohesion and implementation of the action plan, as noted by workshop participants:



“Mutually agreed future vision, however, to action this is going to need commitment and energy by lots of people”

“Children (like me) coming to more than one meeting”

“We have realised that we are not alone in facing the present and anticipated challenges. There are new opportunities on the horizon to work together with other communities and projects”

“The shift in what we first thought the town needed to what the actual outcome was”

## 9. Recommendations moving forward

The co-production of this Plan is the first step on the journey to transitioning towards adaptation.

One of the potential next steps after developing the RAP is for the Tarnagulla community to implement some of these actions. They may need to learn how to monitor their progress and examine whether those actions are leading to the change they had envisioned. If not, they may have to re-adjust their actions. Monitoring is fundamental to taking resilience building from planning to transformation through implementation. It includes identifying who does what, when, how or resourcing and partnerships. Such community-led, incremental, implementation and monitoring of actions will show the success of the transition towards their envisaged future.

Another potential step can be for the PLG to become change leaders and inform a few neighbouring towns in Central Victoria about developing their own RAP. The co-production process that PLG went through can be used as a basis for facilitating workshops in these neighbouring towns. This process can help the Tarnagulla community and a few small towns in Central Victoria to collectively improve their connectedness, build capacities as at a regional scale and potentially adapt to an uncertain future.

The RMIT researchers from Climate Change Transformations group intend to provide advisory or enabling support to the Tarnagulla community to implement their actions within their town or pass-over the co-production approach as a facilitator toolkit for the PLG to become change leaders. Both pathways will allow the community to learn, implement, re-adjust, monitor, document and share the lessons they have learnt in their efforts for community-led adaptation. Having said that, either of these two next steps are reliant on further funding support.

## Appendix

### Proportion of community engagement in the project

The participation and engagement of the Tarnagulla community is identified to be crucial for the success of this project because they have an intimate knowledge of their town, its residents, their strengths and challenges as well as are best placed to come up with solutions to address the challenges.

Overall, a total of 230 participants attended all the workshops, with approximately 20 members actively participating throughout this project. The project launch had the highest attendance with 68 attendees (Nov 2018), with the Stakeholder workshop having the second largest attendance with 57 people.

- 68 attendees = Project launch event (Nov 2018)
- 20 participants = Strengths workshop#1 (including Tarnagulla Ward Councillor Geoff Curnow). While attendance was low, continued participation of Councillor Curnow is a good sign of local government’s interest in this project (Feb 2019)
- 17 participants = Strengths workshop#2 (Feb 2019)
- 20 participants = Challenges and Climate scenario workshop#3 (May 2019)
- 17 participants = Solutions and Actions workshop#4 (Jun 2019)
- 15 participants = Citizen Jury workshop #5 (Jul 2019)
- 57 participants = Stakeholder Event/workshop #6 (Sep 2019)
- 22 participants = Draft Resilience Action Plan reporting for community feedback workshop#7 (Feb 2020)

Apart from the workshops, four surveys were conducted at key stages of the project:

- The first survey was conducted at project launch in fun-based manner, which received 68 responses.
- The second survey was conducted early in the project to understand community’s meaning of resilience and received 25 responses.
- The third survey was conducted mid-stage of the project after strengths and challenges identification, which received 10 responses.
- The fourth survey was conducted at the end of the project after release of the draft report whereby we got 22 responses

### Community endorsements of report

At the launch of draft report, people of all age groups and varied gender participated. 85% of participants endorsed the report while the rest were neutral (Figure 20).

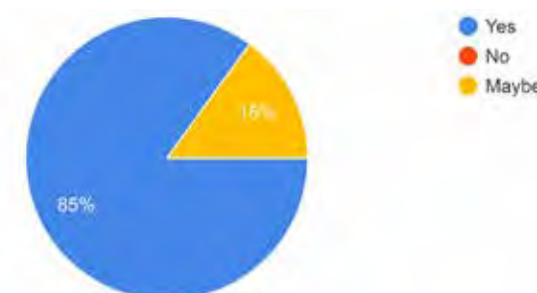


Figure 20: Survey results of endorsement of the draft RAP report (Source: Author)



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Back cover photo: Participants at project launch event (Credit: Mittul Vahanvati)



Tarangulla CFA member at a planned burn in town (Credit: Linda Jungwirth)





## Resilience Action Plan: Tarnagulla Community (2020)

Lead Authors: Mittul Vahanvati, Linda Jungwirth, Kelly Whitton, George Filev, Leigh Mellberg, Paul Davis, Julie Davis, Carmen Scull and Barry Condick

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The Tarnagulla community of the future will be different. Together we will work towards developing and sustaining a thriving town. We will have a strong social culture built on a diverse and connected population representing and welcoming peoples of all ages, status, ethnicities and interests. We will have a beautiful town with a sustainable economy built on local agriculture, businesses, clubs, organisations and tourism. To be resilient we will have developed the necessary capabilities to confidently address our future.

- Tarnagulla community vision