Spatial Vision

SECCCA Enhancing Community Resilience

Case Studies

Paper 5

Final

8th December 2023

About this document

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Cover photo: Bushfire in country Victoria

SECCCA and Spatial Vision respectfully acknowledge the Traditional Owners of the lands on which we work, and pay respect to their Elders, past, present and future. We appreciate and acknowledge the advice and guidance of the Bunurong Land Council in assisting with the consideration of potential climate change impacts on First Nations communities, which for this study began with a focus on the Frankston Local Government Area.

Thanks to the Minderoo Foundation for supporting this project.

Contents

1 Document purpose

As part of the project deliverables for Stage 2 of the Enhancing Community Resilience project, four detailed case studies – nominated by South East Councils Climate Change Alliance (SECCCA) member councils, and selected based on key criteria – were developed to focus on the vulnerability of communities to a climate hazard scenario within a geographic boundary. These geographic case studies were undertaken to apply the broader vulnerability assessment framework developed by the project and demonstrate how to incorporate both the vulnerable sub-population and broader community factors, including community assets, into the analysis.

The geographic case studies were developed in the form of 'Power BI' dashboards. This approach was pursued because of the ability of the dashboards to assist in providing insights and to demonstrate the applicability of output data in visualising community vulnerability considerations in relation to climate hazard scenarios. It is anticipated that by providing the case studies in Power BI format, subsequent user experience and visualisation of data will provide insights that may otherwise not be readily discovered.

This document outlines the purpose and selection process of the case studies, and demonstrates the different pages and possible views that the case studies present. It steps through one of the case studies, *Heatwaves in the growth areas of Cranbourne East and Clyde North*, in detail as an example of how the case studies are delivered and can be interacted with by a user, and highlights examples of the types of key insights the data provide.

This document, referenced as Paper 5, should be read in conjunction with the SECCCA-wide outputs that are provided in the form of Microsoft (MS) Excel tables, PDF maps, and spatial data, as well as the additional Papers 1 to 4 developed as part of this project to gain deeper understandings of the various components of the project:

Paper 1 – *Definitions and Approaches*: Outlines and introduces the key terms and definitions, and proposed conceptual framework by which community vulnerability and resilience to climate change are to be assessed.

Paper 2 – *Vulnerable Populations*: Describes the vulnerable groups within the community, identified by SECCCA councils, to be of concern in relation to the likely impacts of climate change.

Paper 3 – *Methods and Application*: Outlines the process used to identify and assess the vulnerability of sub-populations in the community to climate change. This report provides a detailed explanation of how inputs into the vulnerability assessment method, such as the role of community assets, can be used as an entry point for the building of community resilience.

Paper 4 – *SECCCA-wide Outputs: Findings and Guidance*: Provides an overview of the outputs prepared and findings drawn from the SECCCA-wide evaluation. This report includes high-level guidance on how the outputs can be used to identify where there are likely to be groups or sub-populations in the community that are more vulnerable to climate-related events.

2 Project background

Climate change is significantly increasing risks such as fires, floods, coastal erosion and heatwaves to local communities throughout Australia. Preparing communities for current and future changes to the climate is a critical task and requires protection of life, property, and wellbeing. Proactively preparing communities to act prior to, during and after disasters builds community resilience to future impacts and minimises risks and their consequences.

The Enhancing Community Resilience Project will help prepare communities in the SECCCA region for current and future changes to the climate, by improving community preparedness through practical actions, tools, and resources. Project participants will be empowered with information and access to new or improved services, enabling them to make individual decisions to prepare for climate change.

Leveraging the outputs of the SECCCA Asset Vulnerability Assessment (AVA) project, the project will also assess the vulnerability of the SECCCA region's community to climate change.

Working with SECCCA council members and climate science experts, the project will identify and visualise the community services, demographics, locations, and communities that are exposed to the impacts of climate change. Councils' community planners are integral in understanding vulnerability across communities, including cohorts such as aged care, disability, those with non-English-speaking backgrounds (NESB) and youth.

A further stage of the project will develop, deliver and evaluate interventions to build community resilience to climate risk by working with expert community development practitioners, councils, emergency services, and communities.

The project outcomes and approach will be converted into a practical Toolkit for councils and communities that can be applied in other regions throughout Australia to build community resilience to climate change in these areas. This Toolkit will be developed using a parallel evaluation and collation of lessons learned throughout the project.

For further background information on this project, refer to *Paper 1 – Definitions and Approaches: Appendix A.*

3 Purpose of case studies and use of Power BI

The geographic case study approach involved applying the vulnerability assessment framework to an 'area of interest', which is essentially a geographic area likely to be impacted by a climate-change-related event. The approach assessed community vulnerability by considering factors in addition to the specific vulnerable sub-populations within the area of interest and used this assessment to provide insights to support the building-of-resilience phase of the project. This case study approach aimed to support a more comprehensive and nuanced assessment of community vulnerability, based on how climate change affected capacity factors such as access roads, power outage history, or volunteering levels across the broader community.

Power BI is a powerful and data-driven visualisation tool that presents complex and big data in a consumable and interactive manner. Presenting the case studies in this format allows councils to self-drive the dashboard to interrogate the project outputs, find meaningful insights, and support decision-making processes.

The case-study Power BI dashboards contextualise the project output data by collating information into a narrative defined around a specific climate hazard scenario. Power BI then presents the information in a range of visual formats, including maps, graphs, and tables, to support textual descriptions of context and insights.

The multi-page dashboards guide the user through a climate hazard scenario and the vulnerable populations of concern before presenting maps of broader community factors and graphical representations of capacity considerations. The final page of the dashboard provides a graphical visualisation where the user can combine key climatic, vulnerability or contextual indicators to garner deeper insights into scenarios of concern.

Presenting the case studies as Power BI dashboards also demonstrates to councils how the project outputs can be presented, combined and interpreted, and provides exemplars for replicability.

4 Case study selection process

Project Working Group members were requested to submit nominations for potential case studies using selection proformas. The councils self-assessed their nominations against key criteria, which included:

- identification of the climate hazard scenario and the vulnerable sub-populations of concern
- details on the justification and description of why this scenario and these sub-populations were identified
- priority and severity of scenario
- whether the scenario would impact other councils
- availability of council representatives to assist, and their level of knowledge
- key physical assets based on services provided, or other factors impacting capacity
- availability of data to support the assessment.

Five case studies were nominated by councils and each criterion was rated by the Spatial Vision team to determine the final four case studies (see Table 1).

LGA Nominations and SV Team Rating

Council	Case Study Number	Case Study Area	Scenario / Event	Crit 1 Priority	Crit 2 Other LGAs	Crit 3 Specific Vul Sub-Pop	Crit 4 Available Reps/Staff	Crit 4 Available Data	Total (based on Criteria)	Overall SV Team Rating	SV Team Comments
Kingston	KG1	Residents who live south of Mordialloc Creek	Flood and Heat	M	M	H	H	H	H	1	Very good case study for overland flood and coastal impacts
Casey	CY1	Inundation of Casey Coast	Coastal inundation (storm and tidal)	M	H	H	H	M	M+	2	Good case study for coastal impacts (but due to LGA distribution considerations has been assigned a rating of serious contender only).
Casey	CY2	Heatwaves in Growth Areas/ New Estates	Urban heat and heatwaves	M	H	H	M	M	H	1	Good case study for heat impacts
Mornington Pen	MP1	Safety Beach to Rosebud (including Dromana and Capel Sound)	Flood, Heat and Coastal	H	M	H	H	M	M+	1	Good case study for coastal impacts
Cardinia	CA1	Gembrook/Cockatoo	Wildfire event	H	H	H	H	M	M+	1	Good case study for wildfire

Table 1: Case study nominations from councils. Key: M = Medium rating, H = High rating; 1 = highest rating, 2 = lowest rating. Coloured rows indicate highest-scoring case studies based on criteria.

5 Overview of case studies

From the nominations provided by SECCCA member councils, four geographic case studies were selected for implementation using the Power BI dashboard. The four case studies chosen aimed to provide representation of climate hazards, vulnerable sub-populations and geographic context.

5.1 Heatwaves in the growth areas of Cranbourne East and Clyde North

This case study focuses on the impact of heatwaves on vulnerable populations in the growth area and new estate regions of Cranbourne East and Clyde North. The region already experiences, and is anticipated to continue experiencing, intense heatwaves, the impacts of which are compounded by the urban heat island effect and low canopy cover.

The community is characterised by higher populations of people from NESB, high rates of young families with very young children, and high rates of housing stress. This case study highlights the distribution of key vulnerable populations within the region to heatwaves, in the context of the broader community factors and capacity considerations that potentially heighten, or reduce, vulnerability.

5.2 Bushfires in Cockatoo and Gembrook

This case study focuses on the impact of bushfires in the Cockatoo and Gembrook regions of Cardinia Shire. These geographic areas have a high threat of bushfires and wildfires, with the majority of the area being within the Bushfire Management Overlay with bushland, forest in the broader region and a history of fires that have threatened Cockatoo and Gembrook. The most significant bushfire was 'Black Wednesday' in 1983, which directly impacted Cockatoo by killing six people, destroying 307 buildings and burning 1800 hectares.

The region also has close proximity to remnant bushland and vegetation, undulating terrain with agriculture, bushland and forest. It is known to have a high fuel load with two significant forests, Wrights Forest and the Bunyip State Forest, both being adjacent to Cockatoo and Gembrook.

If fire risk is escalated with high wind speeds, high temperatures, low humidity, dry fuels and high fuel load conditions, a bushfire could spread swiftly with devastating effects on the short- and long-term viability of the communities and the region.

The hills region also has challenges inherent to the area, namely the sense of social and physical isolation, access and egress with one road in and one out for many communities, and the susceptibility to disruption of the telecommunication and energy infrastructure during a climate hazard.

The region hosts a wide range of demographic groups, with low socio-economic challenges that increase the inherent vulnerability of people living in the area. The area is highly reliant on the neighbouring towns of Emerald and Pakenham.

5.3 Inundation at Rosebud

Mornington Peninsula Shire nominated the coastal area extending from Safety Beach to Capel Sound due to the significant social vulnerabilities within the community, including significant poverty, homelessness, young people, people with a disability, older people and those with low income. This area is particularly vulnerable to coastal processes such as inundation caused by tidal flooding and storm surges.

Key climate risks identified in this area include:

- Jetty Road and Point Nepean Road intersection regularly inundates due to extensive runoff and reduced discharge efficiency at outlet at times of high tide. This example highlights the issue of low-lying critical infrastructure such as roads, businesses and leisure facilities going underwater during compounding rainfall events and high tide levels.
- The Murray Anderson creek outlet became buried under sand, creating pits upstream near the road and further upstream surging due to heavy runoff. This highlights the vulnerability of coastal communities to heavy rain events and possible outfall efficiency reduction due to sand migration and storm surge events. Repeated clearing of sand after heavy storm events would be cost-prohibitive. Determination of alternate designs is prudent.
- 7-Eleven fuelling aisles at Point Nepean Road flooded due to sediment build-up in foreshore pits. This highlights the impacts ranging from business and recreation losses due to inundations, aggravated maintenance requirements and potential environmental threats of inundation into areas such as fuel stations or contaminated tip sites.
- Drainage assets in easements in Dromana Bowl and Safety Beach become inundated in low-lying areas.

5.4 Inundation south of Mordialloc Creek

This case study focuses on the vulnerable populations located south of Mordialloc Creek in relation to flooding. Of particular concern are those who are over the age of 65, those who require high care, those on a low income and those experiencing homelessness.

In the event of a flood in local streets, older people and people with disabilities who need assistance are at greater risk due to being isolated in their homes. They may rely on people being able to visit their home for personal care, taking medicine, home nursing or provision of meals. These supports and services would not be able to reach them in the case of a flood blocking access to their home.

Kingston City Council shares flood management responsibilities with Melbourne Water. Flooding is a significant issue for the community and creates challenges for the council and Melbourne Water. Many of Kingston's low-lying bayside suburbs experience localised shallow flooding during minor storm events. Kingston is unique in that it is reliant on a significant number of stormwater pumping stations as part of its drainage network.

6 Case study components – dashboard demonstration

This section presents one of the four case studies in detail to demonstrate the interactivity and the possible insights garnered from the collation and presentation of data in this format.

Screenshots of key views for each page are presented, alongside brief descriptions of the information presented and insights based on this information.

The Power BI case studies have seven pages for the user to explore and interact with:

1. *Home page*: a brief overview of the case study and its context in relation to the key vulnerable populations and climate hazard
2. *Climate view*: information and views of the climate hazard and related climate variables
3. *Vulnerable populations*: information related to the vulnerable populations of concern, with absolute populations of key vulnerable populations as well as the vulnerability rankings of these populations
4. *Broader community factors*: information related to the additional factors that may influence general vulnerability and self-sufficiency in light of an extreme event or disaster
5. *Broader capacity considerations*: information related to assets and services that, when impacted in the event of an extreme climate event, can increase the general vulnerability of a community
6. *Intersection climate and vulnerability*: allows interaction with the data to display user-defined variables that relate to vulnerable populations, climate events, and broader community factors and capacity considerations in combination to provide insights and deeper contextual understanding
7. *Definitions*.

The example case study detailed in this section is *Heatwaves in the growth areas of Cranbourne East and Clyde North*. This case study is highlighted as the example in this section as it was rated the highest priority (Table 1).

6.1 Home page

Purpose

The purpose of the home page (Figure 1) is to introduce the case study's focus climate hazard event and context, and the general profile of the focus area, in relation to the key vulnerable populations. A map of the case study area is provided for geographic context, and a tabular overview of average vulnerability rankings compared with the SECCCA and LGA(s) averages. The user can navigate to any other page by selecting the relevant button.

Key insights:

- Case study area is highly dense, with a total population of ~127,000 people, with high populations of those aged over 65 (8,759 people) and those from NESB recent arrivals within the last 5 years (9,685 people).
- Case study area generally has lower average vulnerability rankings compared with Casey and Cardinia LGAs, and the SECCCA average, with the exception of single mothers.

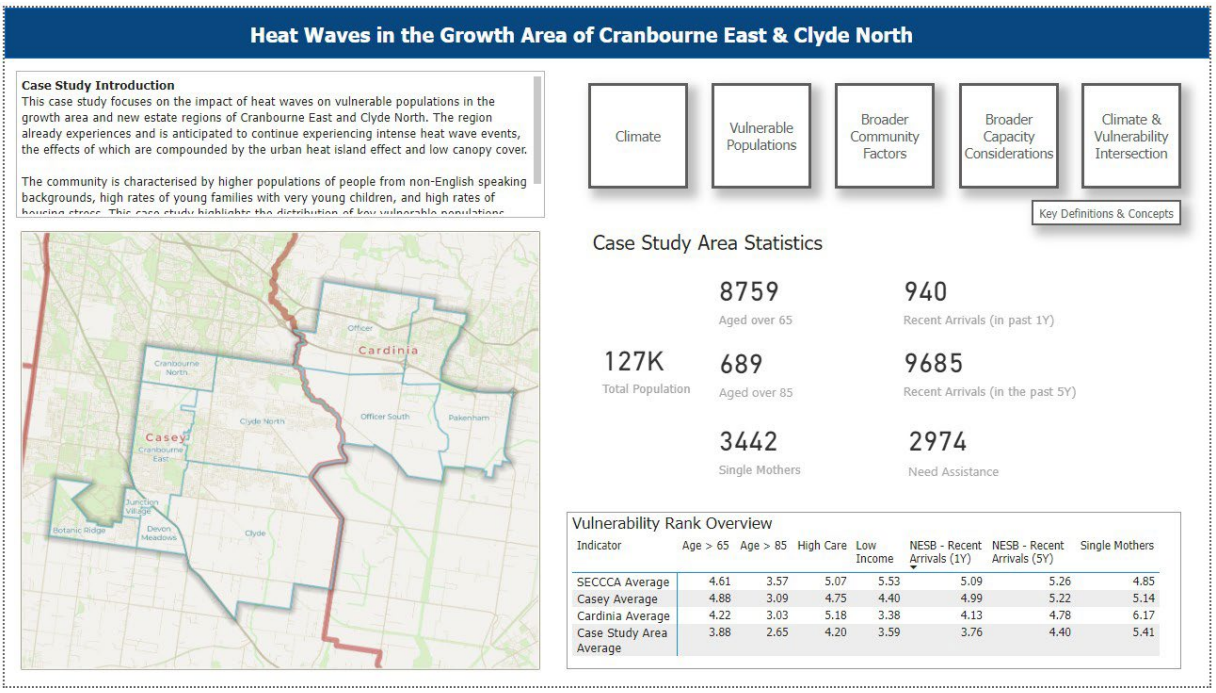

Figure 1. Home page – heatwaves.

6.2 Climate page

Purpose

The climate page (Figure 2, Figure 3, and Figure 4) highlights the climate profile of the case study, with climate hazards relevant to the case study defined and mapped, and key statistics highlighted. For this case study, three key climate variables were mapped (as a percentage change from the 1981–2010 baseline): heatwaves, extreme temperature at 1 per cent Annual Exceedance Probability (AEP), and heat health. The user can view each of these maps and related statistics by selecting the relevant button.

Key insights:

- Heatwave events are expected to increase significantly across the entire case study region (all regions to increase by a minimum of about 200 per cent by 2050), particularly in the north-west regions of Pakenham and Officer.
- Clyde, Clyde North and Cranbourne East are expected to have the highest increase in extreme temperatures by 2050.
- The number of days exceeding the heat health threshold is expected to significantly increase across the case study area, in particular for Pakenham, Officer South, Officer and Clyde North.

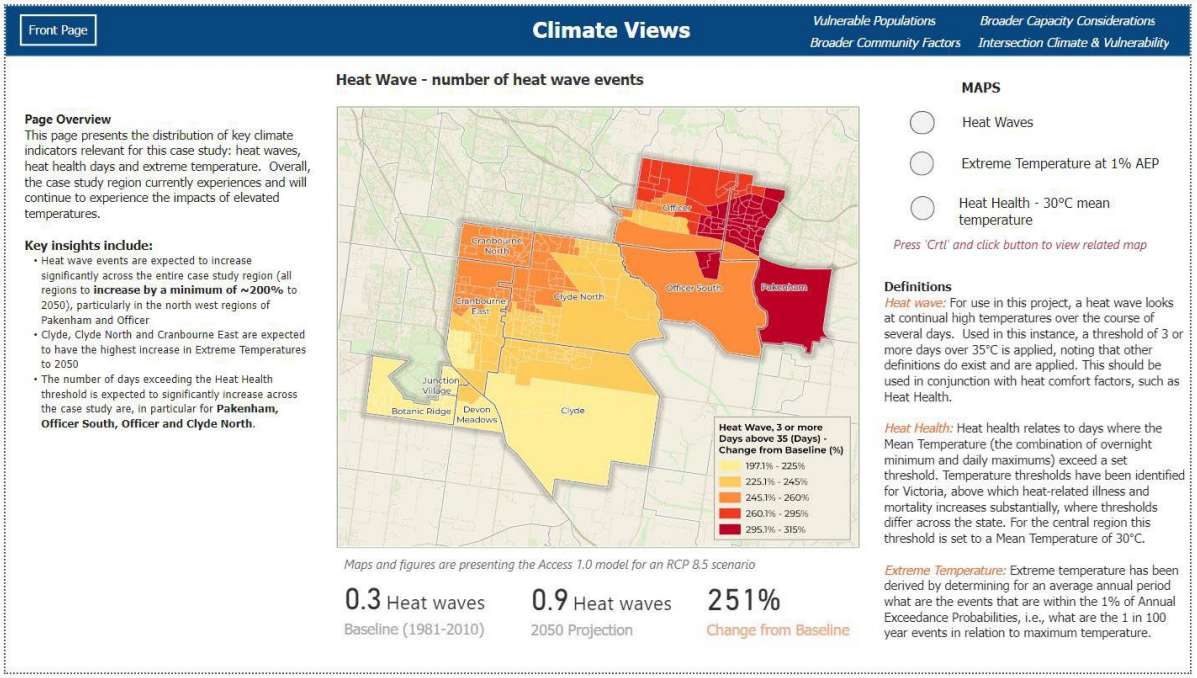

Figure 2. Climate view – heatwaves.

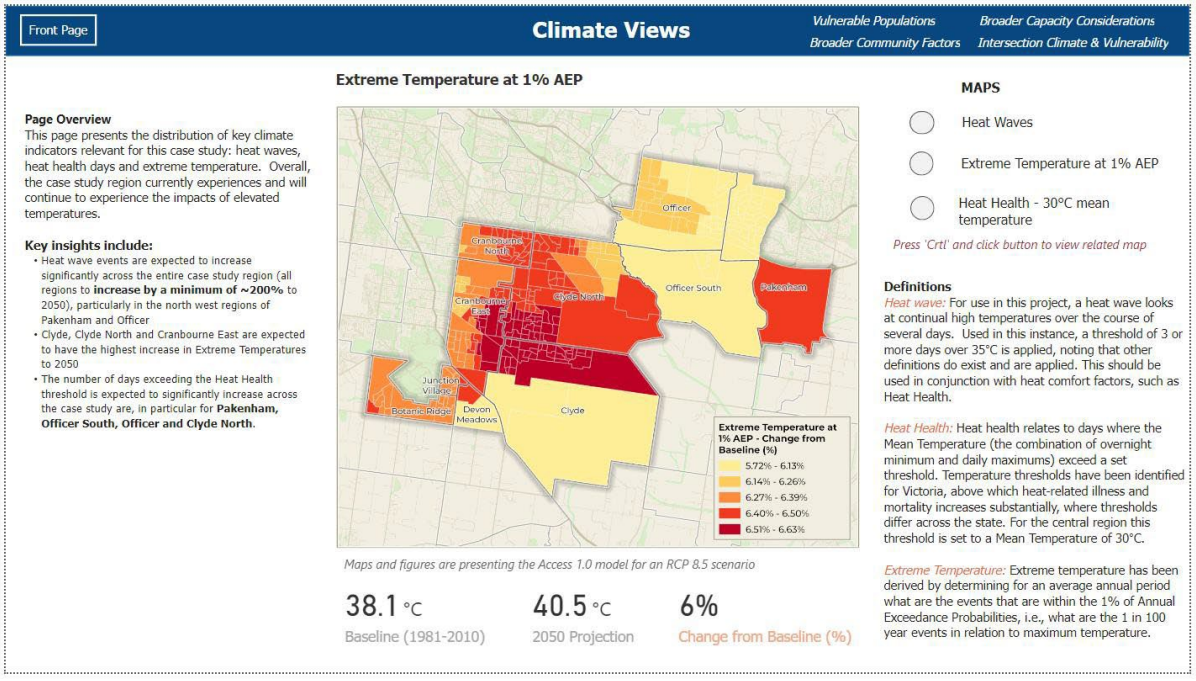

Figure 3. Climate view – extreme temperature at 1 per cent AEP.

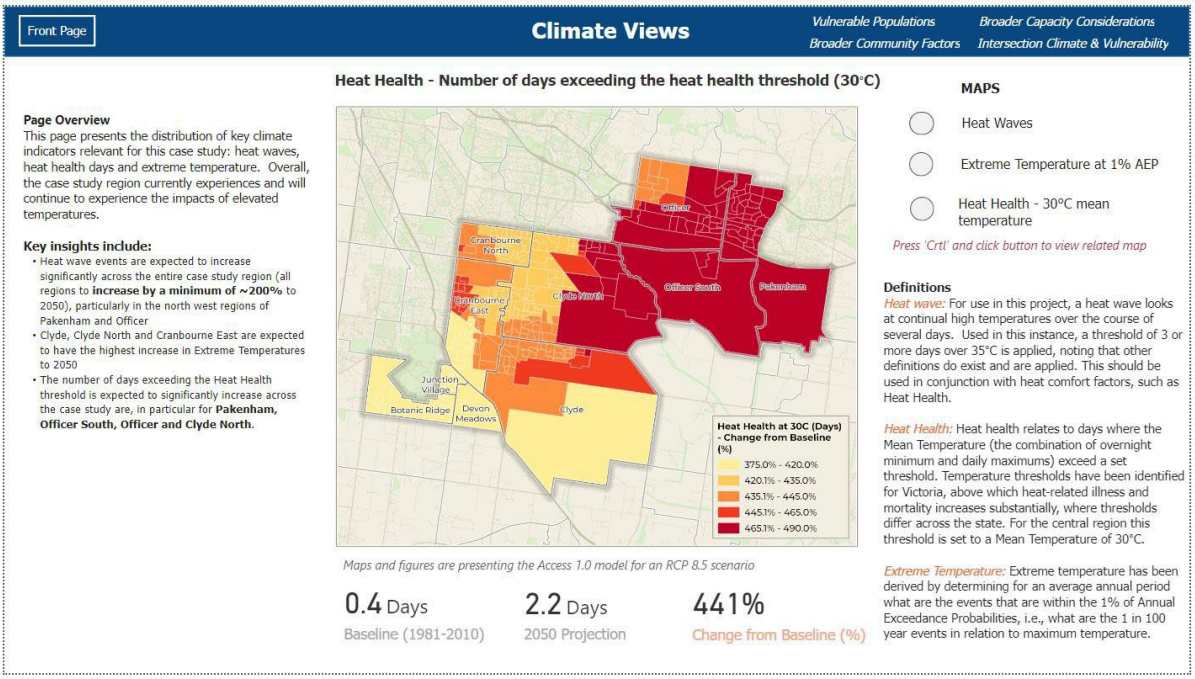

Figure 4. Climate view – heat health.

6.3 Vulnerable populations

Purpose

The vulnerable populations page (Figure 5 and Figure 6) presents a range of visual formats related to the key populations of concern related to the case study. This case study focuses on older people, recent arrivals with a NESB, single mothers, those who require high care, and those on a low income. The user can choose to see the distribution of these populations at a Statistical Area Level 1 (SA1) as either total populations or as a vulnerability ranking.

To facilitate understanding of the distribution of these populations, total populations and averages are aggregated to a suburb level. The drop-down item on the page allows the user to filter the statistics and table by suburb. Selecting the table column headings can sort the chosen population type from highest to lowest (or vice versa) to see which suburbs have the highest vulnerability rankings.

The user can use this mapping, statistic and tabular information to identify pockets of vulnerable populations, prioritise suburbs with higher vulnerable populations, and visually understand the distribution of populations across the case study area.

Key insights:

- Devon Meadows has moderate to high vulnerability rankings for the low income, high care, single mothers and aged-over-65 sub-populations.
- Cranbourne East has the highest population of those aged over 65 and 85. Those aged over 85 have a low average vulnerability ranking, likely reflecting the aged residential facilities within the region (Figure 5).
- Botanic Ridge generally has a high mean household income, and low numbers of the sub-population groups. The vulnerability of these sub-populations ranges from low to moderate, with the exception of single mothers, who have a moderate to high average vulnerability of 6.8 (Figure 6).

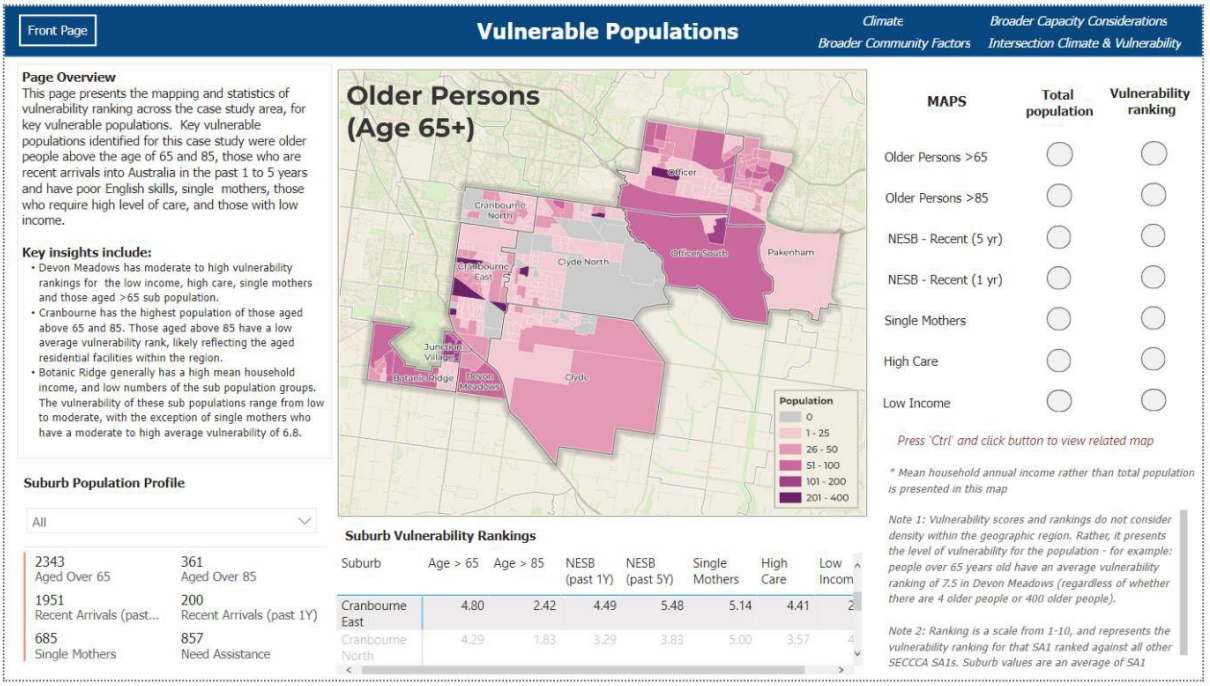

Figure 5. Vulnerable populations – older people by total population.

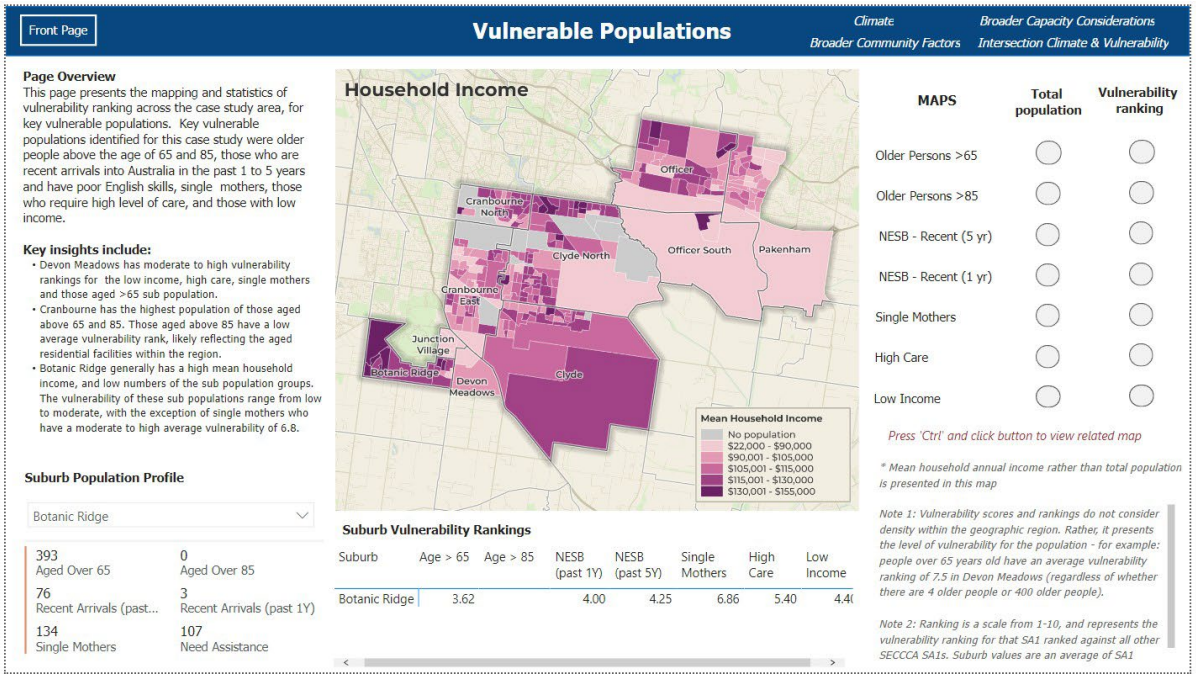

Figure 6. Vulnerable populations – mean household income, focusing on Botanic Ridge.

6.4 Broader community factors

Purpose

Within a given location, a number of additional factors may influence general vulnerability and self-sufficiency relating to an extreme event or disaster. This is the case not only for vulnerable populations but also for the community as a whole.

These broader community factors can relate to how self-sufficient the given population is, what general health concerns may exist, and how well-connected or trusting the community is.

This page presents a number of measures that act as an indicator of broader community resilience or vulnerability across a larger geographic area (Figure 7 and Figure 8).

Key insights:

- The case study area has a high rate of new residents, with 50 per cent of residents in the area having had a different address 5 years ago (Figure 7). Half the population is concentrated in the Clyde and Clyde North suburbs, highlighting these new development areas. New residents in an area may have lower experience with the local climate conditions, and hence may have a higher vulnerability to heatwaves.
- Botanic Ridge, Cranbourne East, and parts of Pakenham and Officer have higher populations of people with respiratory conditions (Figure 8).

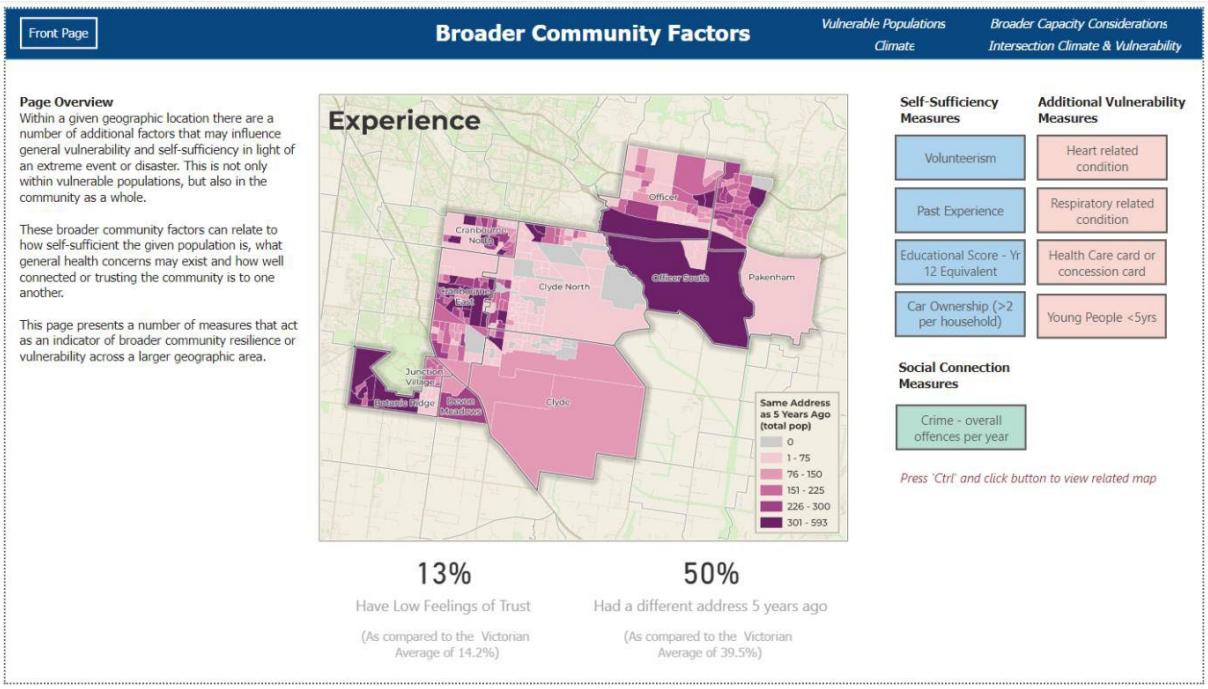

Figure 7. Broader community factors – same address as 5 years ago (indicating possible past experience).

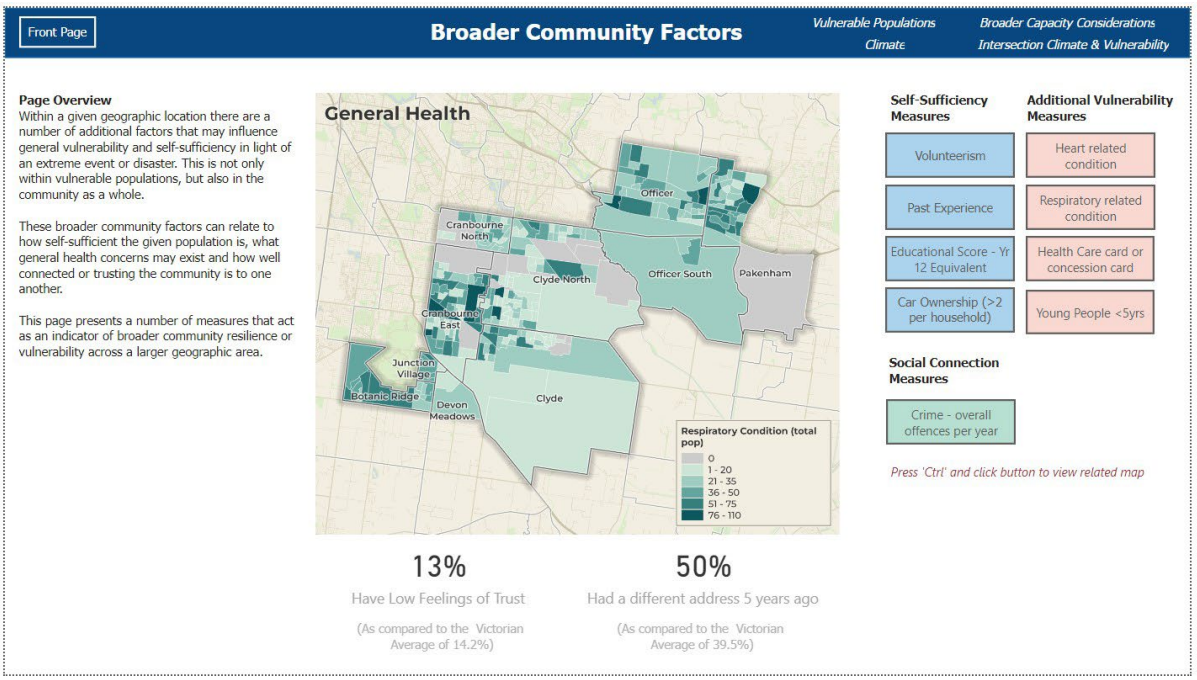

Figure 8. Broader community factors – respiratory condition population.

6.5 Broader capacity considerations

Purpose

A location or geographic community can have assets that provide a number of services to the area. These assets provide broader capacities. Based on the location, coverage, distance or level of service provided, they can potentially mitigate impacts of an extreme event. If these assets or services are impacted during an extreme event, there can be an increase in general vulnerability.

This can relate to key infrastructure and utilities, emergency services, social assets and other general sufficiency assets such as banks or supermarkets.

This page (Figure 9 and Figure 10) presents graphical representations of key broader capacity considerations.

Key insights:

- All SA1s in all suburbs have relatively good access to supermarkets, pharmacies and banks Access to public transport varies across the case study region; for example, all SA1s in Pakenham have access within 400 m while Officer South has no public transport within 440 m (Figure 9).
- Most suburbs are well-serviced in regard to coverage for ambulances, fire stations, hospitals, neighbourhood safe places (NSPs) and police stations. Distance to NSPs is lower for Officer, Officer South and Pakenham (Figure 10).

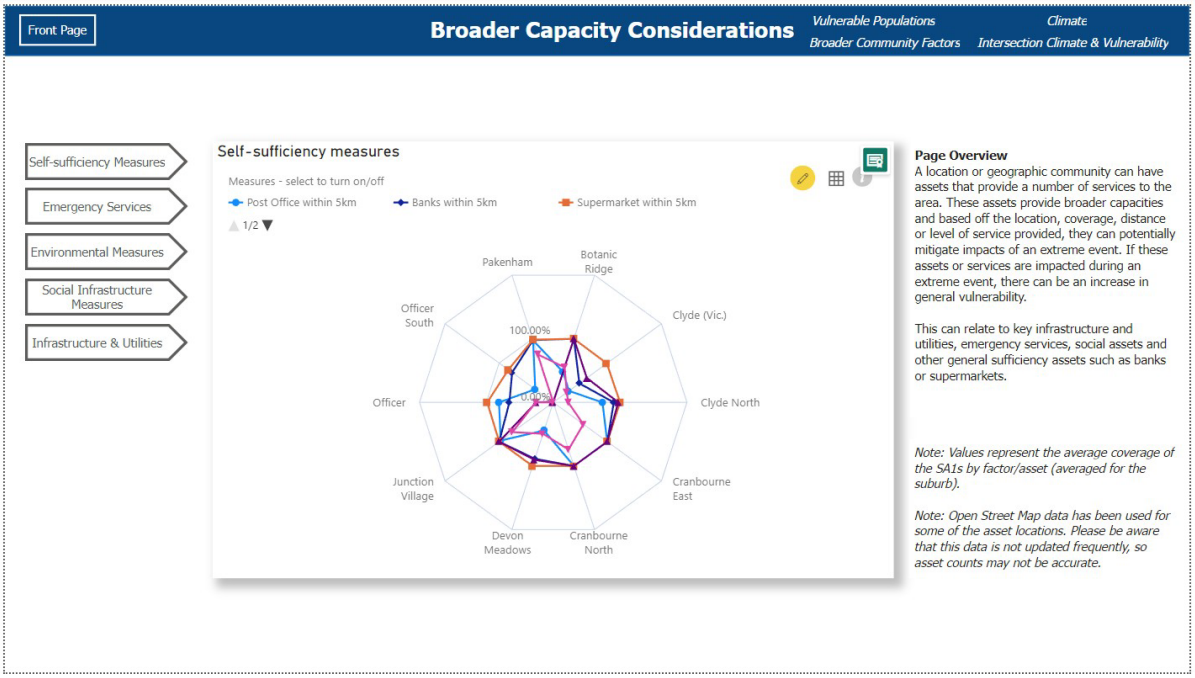

Figure 9. Broader capacity considerations – self-sufficiency measures.

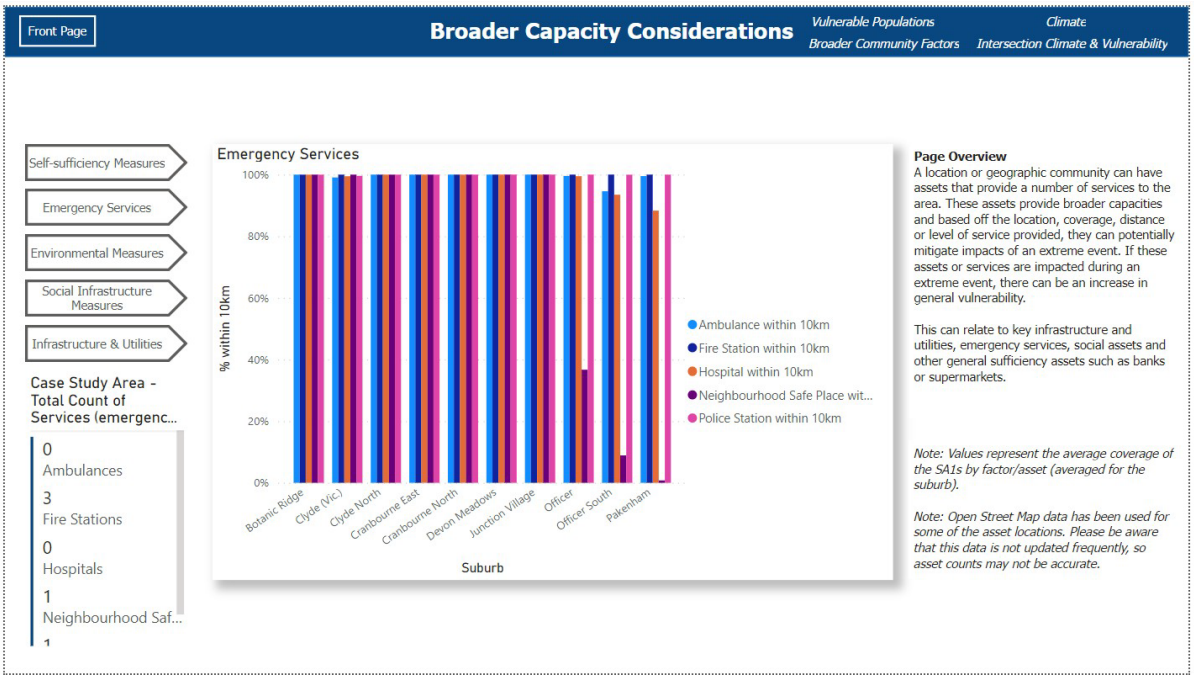

Figure 10. Broader capacity considerations – emergency services.

6.6 Climate and vulnerability intersection

Purpose

This page presents combinations of key vulnerable populations across suburbs with additional relevant indicators (Figure 11 and Figure 12). The purpose of visually combining vulnerability ranks with other indicators on a combination graph is to present scenarios that generate deeper thought and discussion.

Key insights:

- People on a low income and those aged over 85 are highly vulnerable in Officer South. This area is expected to have an increase in heatwave events of almost 300 per cent by 2050. SA1s in the suburbs have no access to any public transport within 400 m (Figure 11).
- In comparison with Officer South, although older people aged over 85 in Devon Meadows are highly vulnerable (with an average vulnerability ranking of 7.5) the heatwave change from baseline is expected to be lower, at about a 215 per cent increase as opposed to a greater than 300 per cent increase (Figure 12).
- Although the four sub-population presented generally have low vulnerability rankings, Pakenham is expected to experience the greatest increase in heatwave events and heat health days by 2050 (Figure 12).

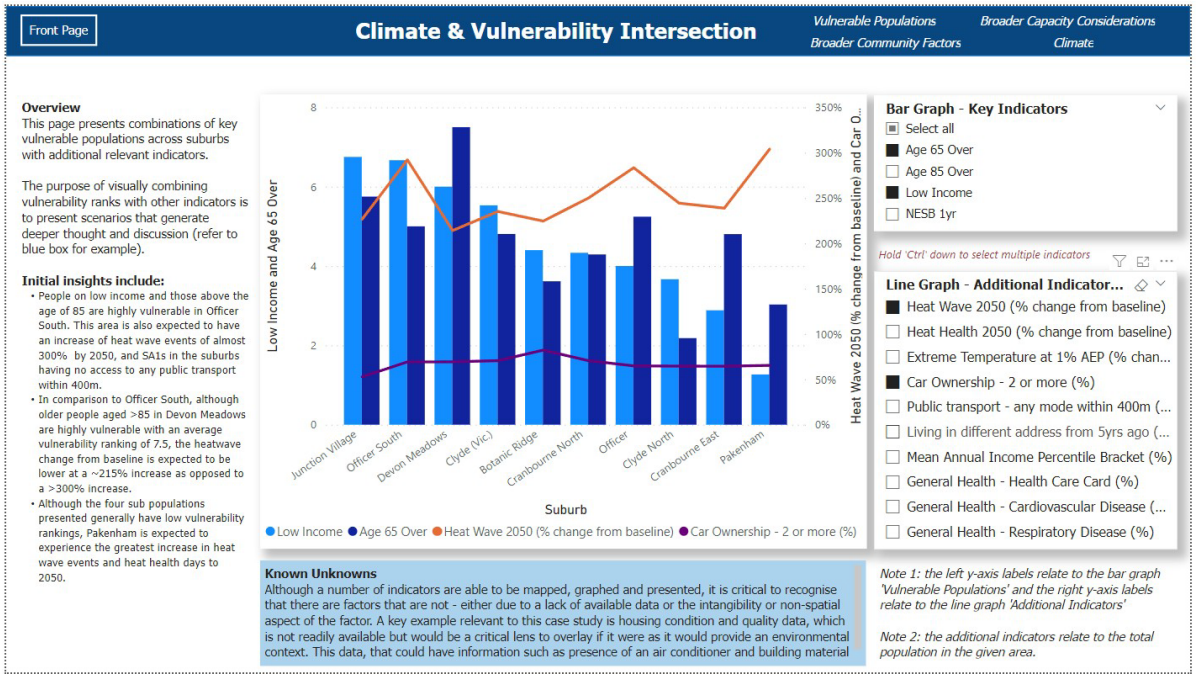

Figure 11. Climate and vulnerability intersection – low income, aged over 65, heatwave (per cent change from baseline) and car ownership.

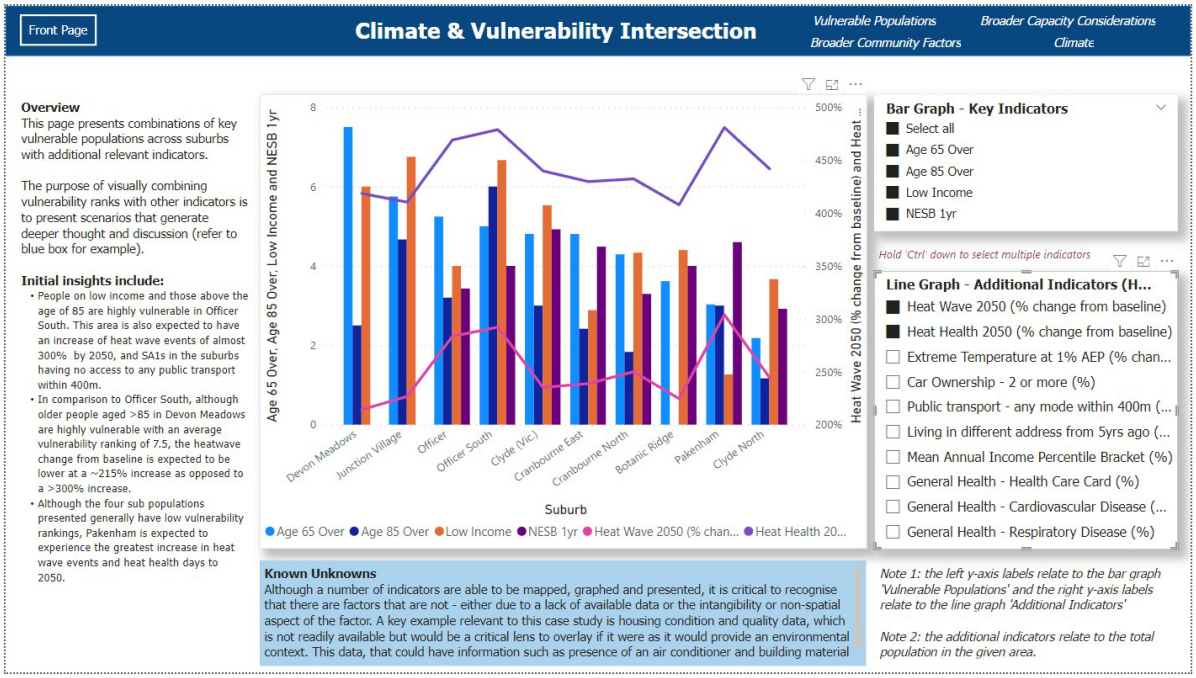

Figure 12. Climate and vulnerability intersection – aged over 65, aged over 85, low income, NESB (within 1 year), heatwave (per cent change from baseline) and heat health (per cent change from baseline).

7 Appendix A: Other case study Power BI visualisations

The following images present singular screenshots for the case study dashboards for each case study. Although not presenting as much detail as the heatwaves case study above, key insights for some pages are textually described in the screenshots.

7.1 Inundation south of Mordialloc Creek

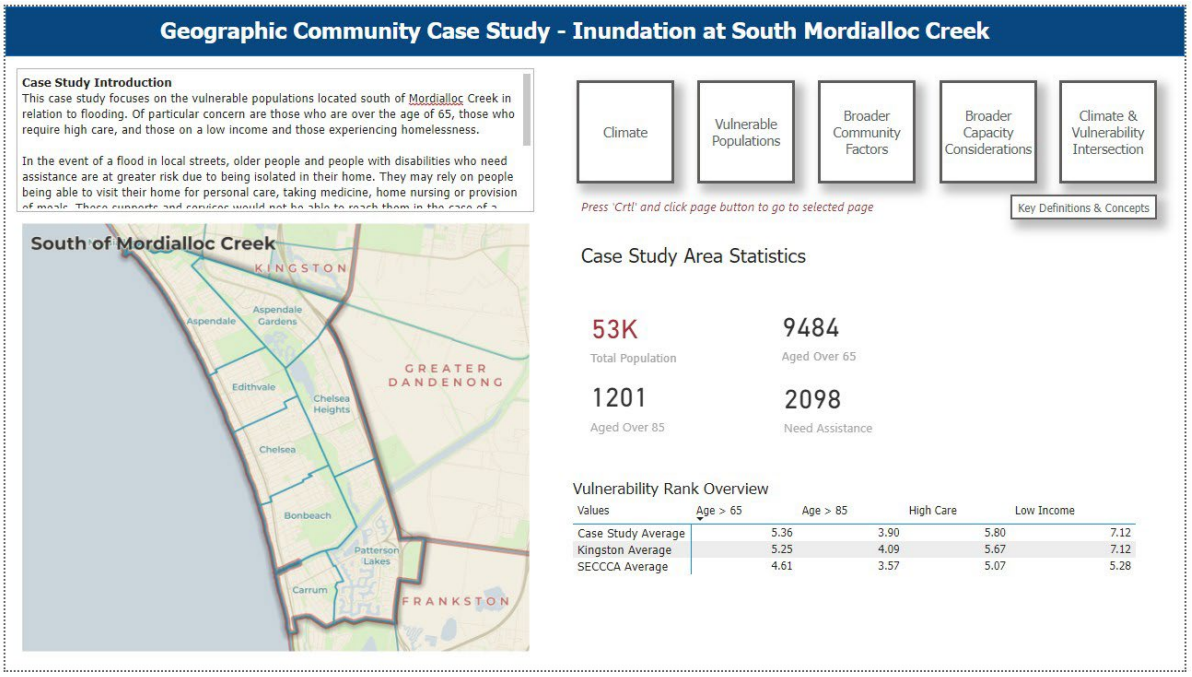

Figure 13. South Mordialloc Creek case study – home page.

The 1-in-100-year flood extents shown in this case study are based on information that is shown within the Kingston Planning Scheme. This data will be superseded by the findings from a joint Melbourne Water and City of Kingston flood modelling study across the entire municipality. The new mapping, incorporating the latest climate change forecasts, will provide valuable data that can be used to inform broad consultation with vulnerable communities.

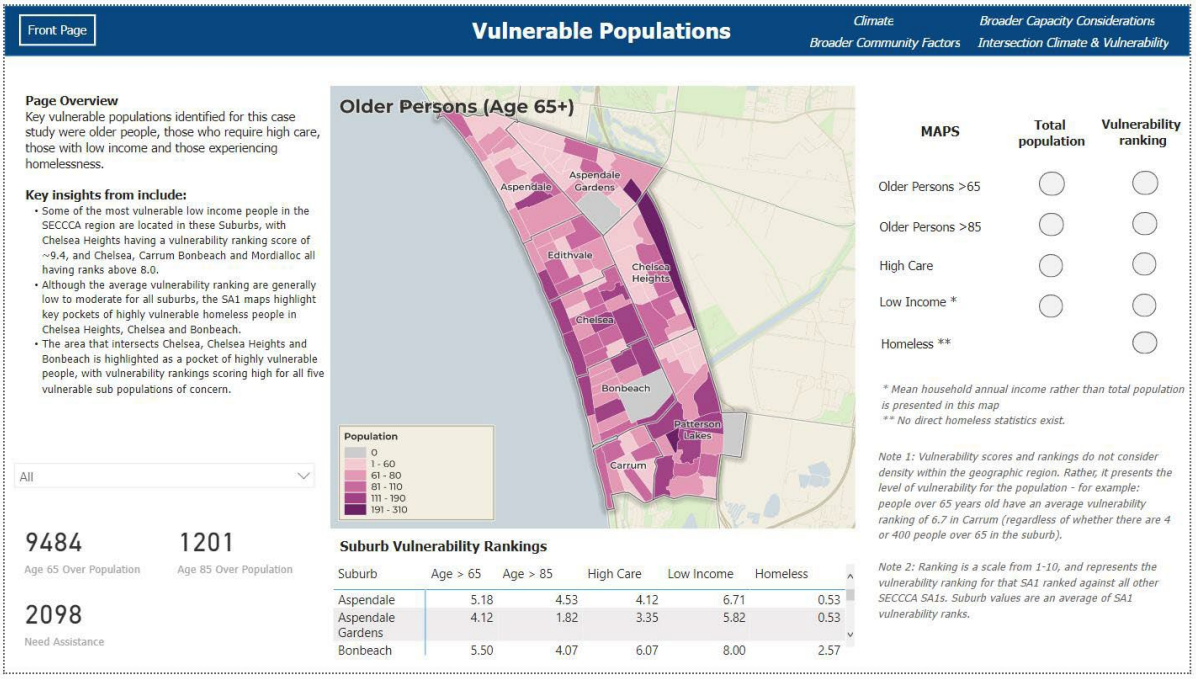

Figure 14. South Mordialloc Creek case study – vulnerable populations page (with key insights).

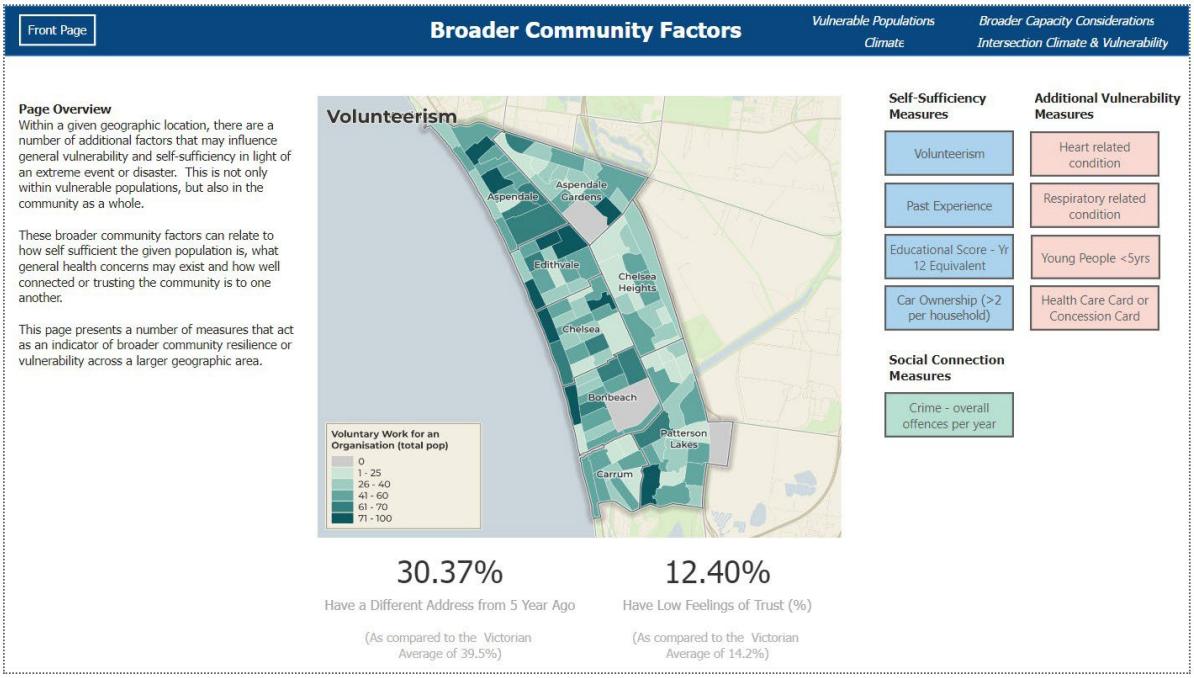

Figure 15. South Mordialloc Creek case study – broader community factors page.

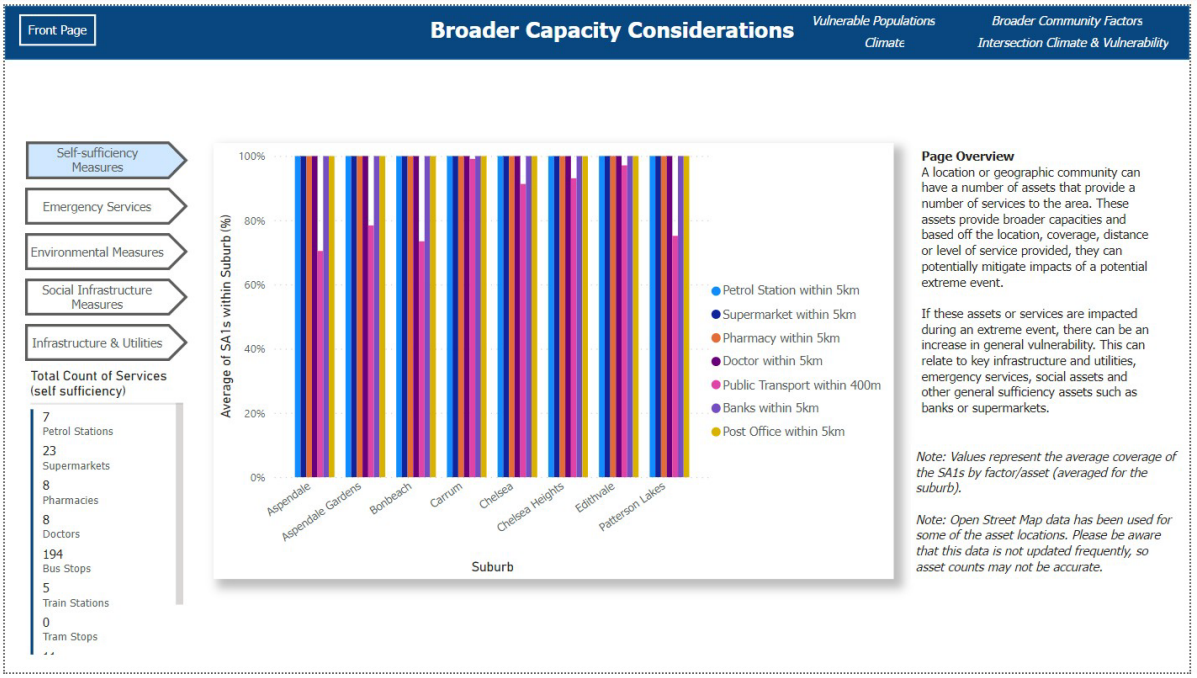

Figure 16. South Mordialloc Creek case study – broader capacity considerations page.

7.2 Inundation at Rosebud

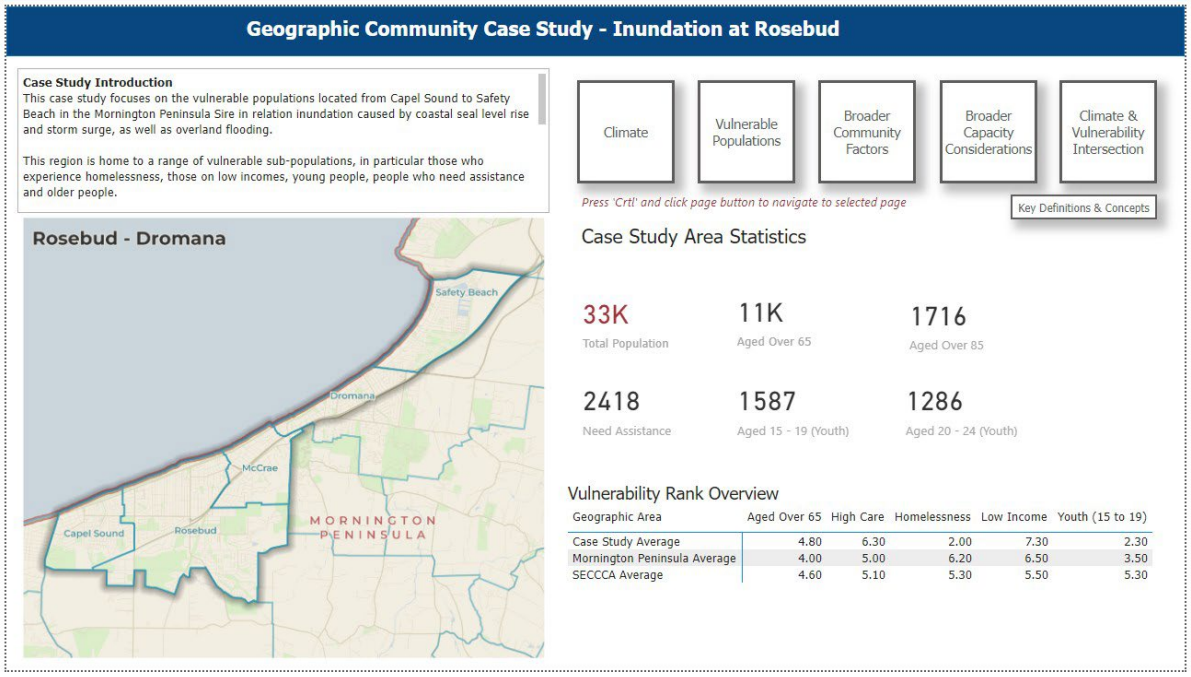

Figure 17. Rosebud case study – home page.

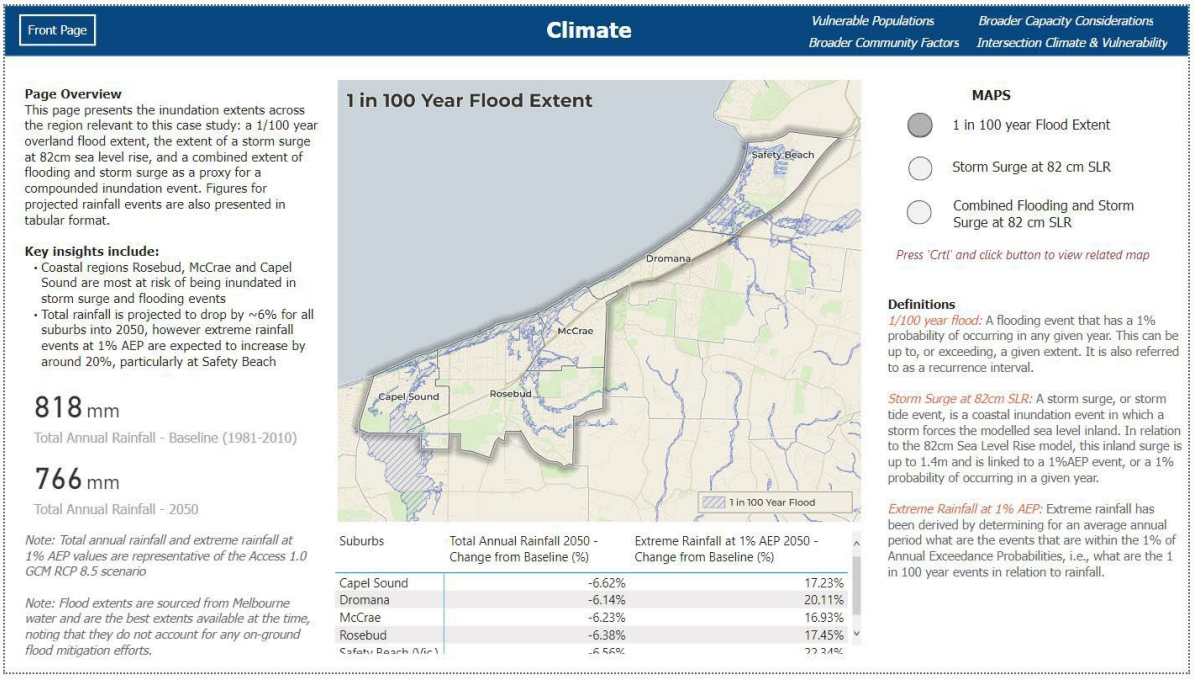

Figure 18. Rosebud case study – climate page (with key insights).

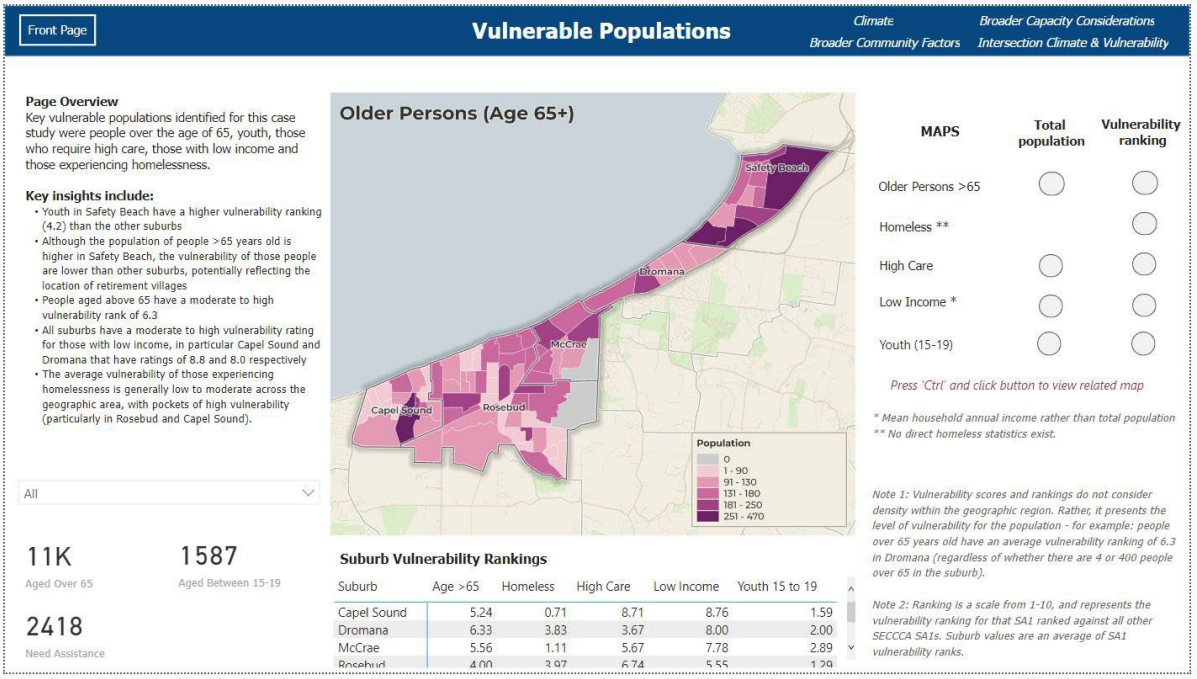

Figure 19. Rosebud case study – vulnerable populations page (with key insights).

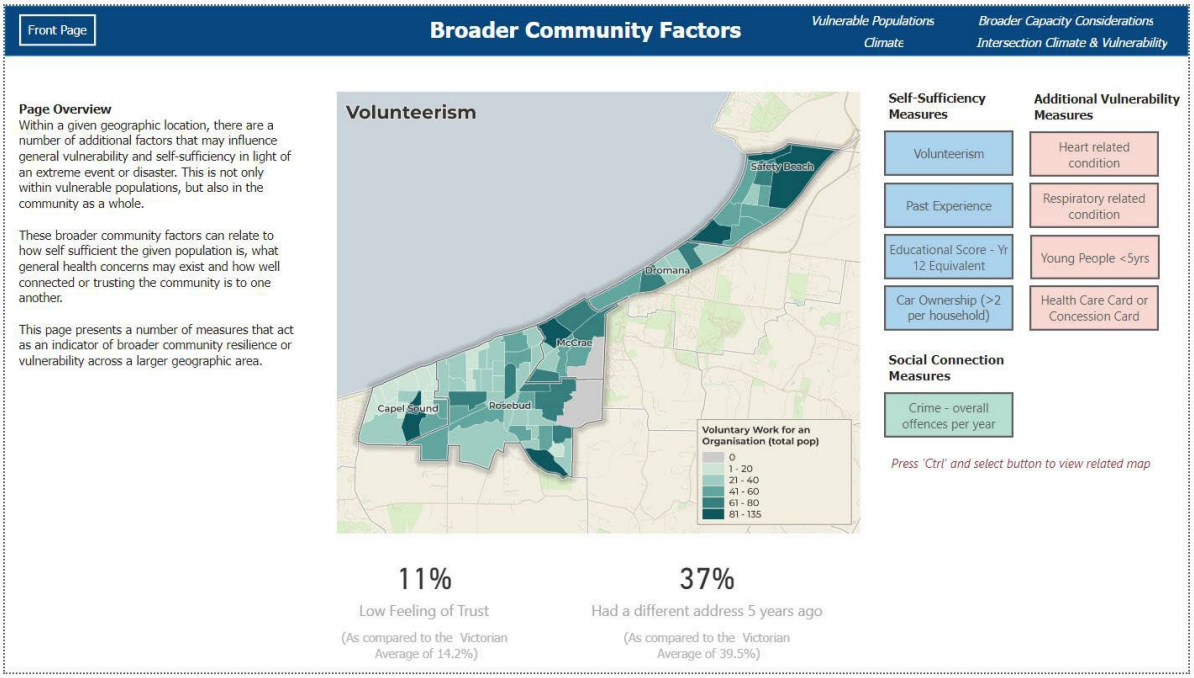

Figure 20. Rosebud case study – broader community factors page.

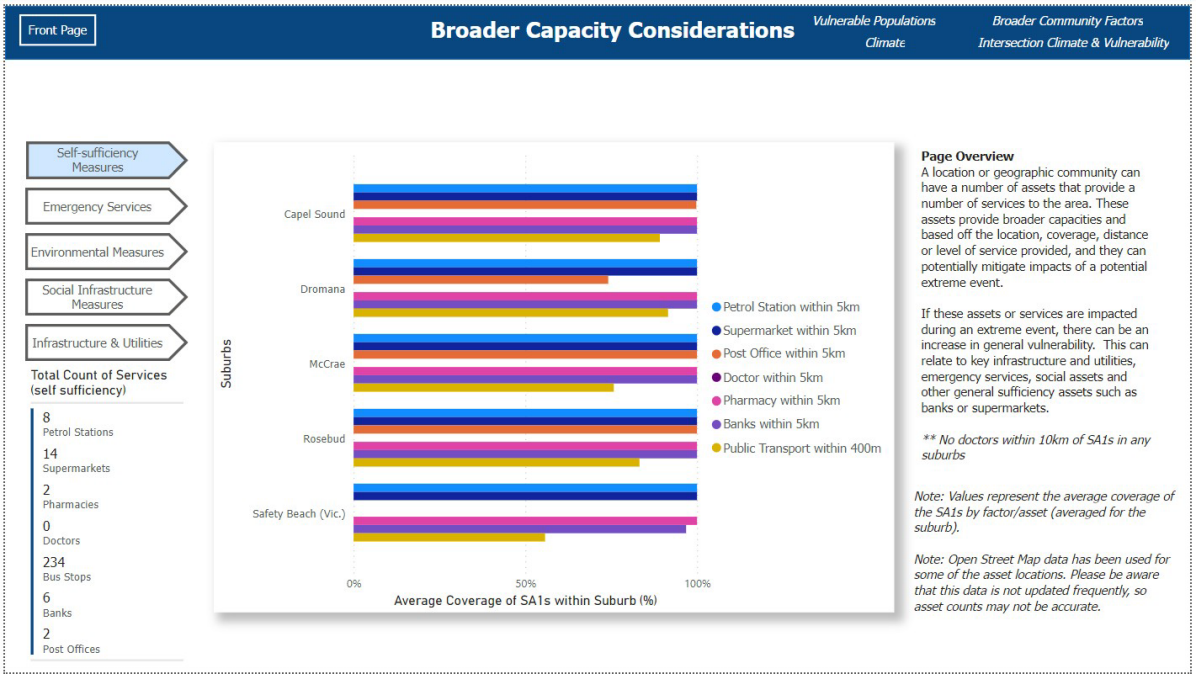

Figure 21. Rosebud case study – broader capacity considerations page.

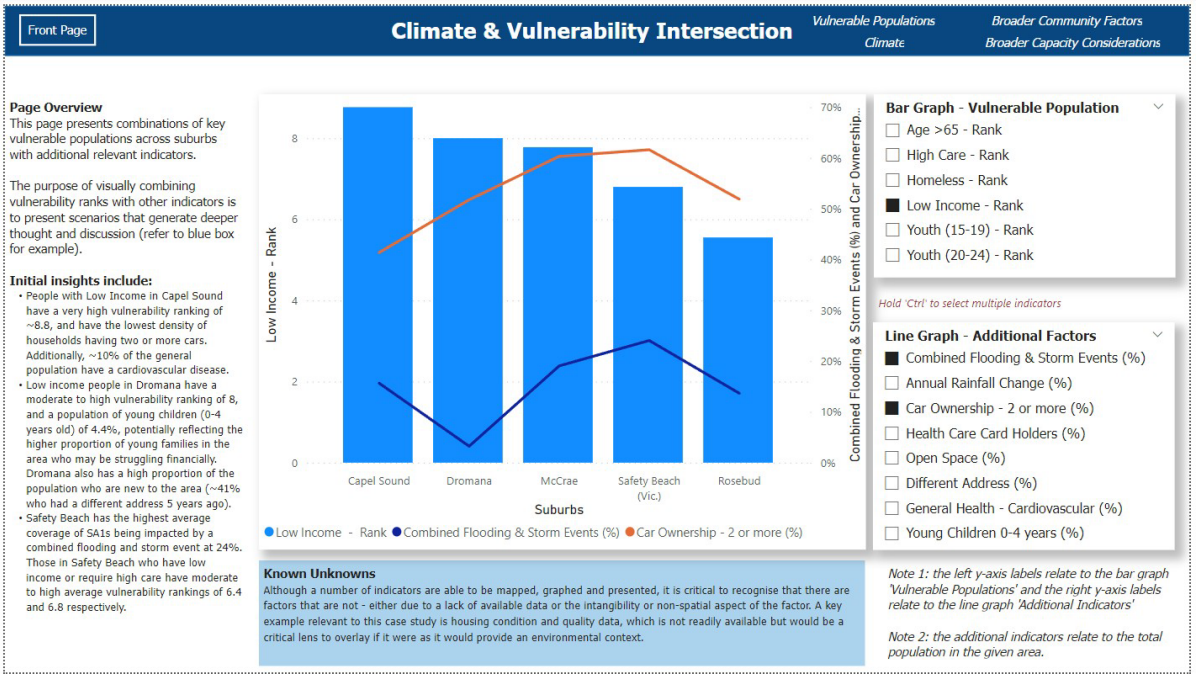

Figure 22. Rosebud case study – climate and vulnerability intersection page (with key insights).

7.3 Bushfire at Gembrook and Cockatoo

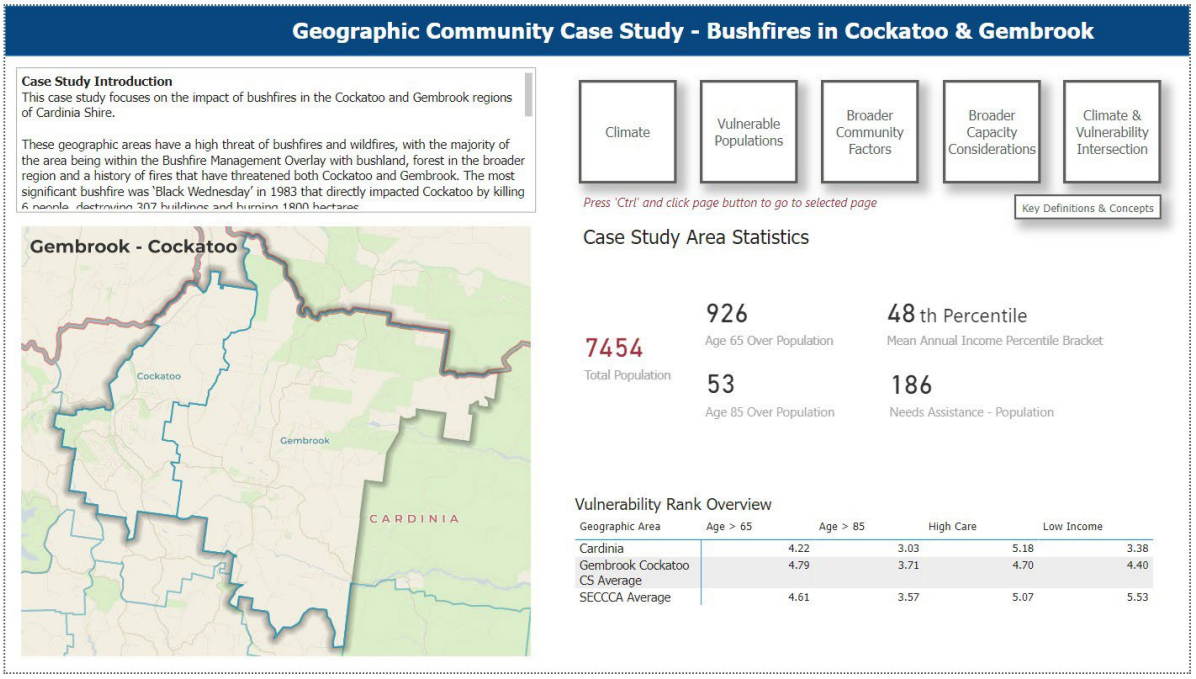

Figure 23. Gembrook and Cockatoo case study – home page.

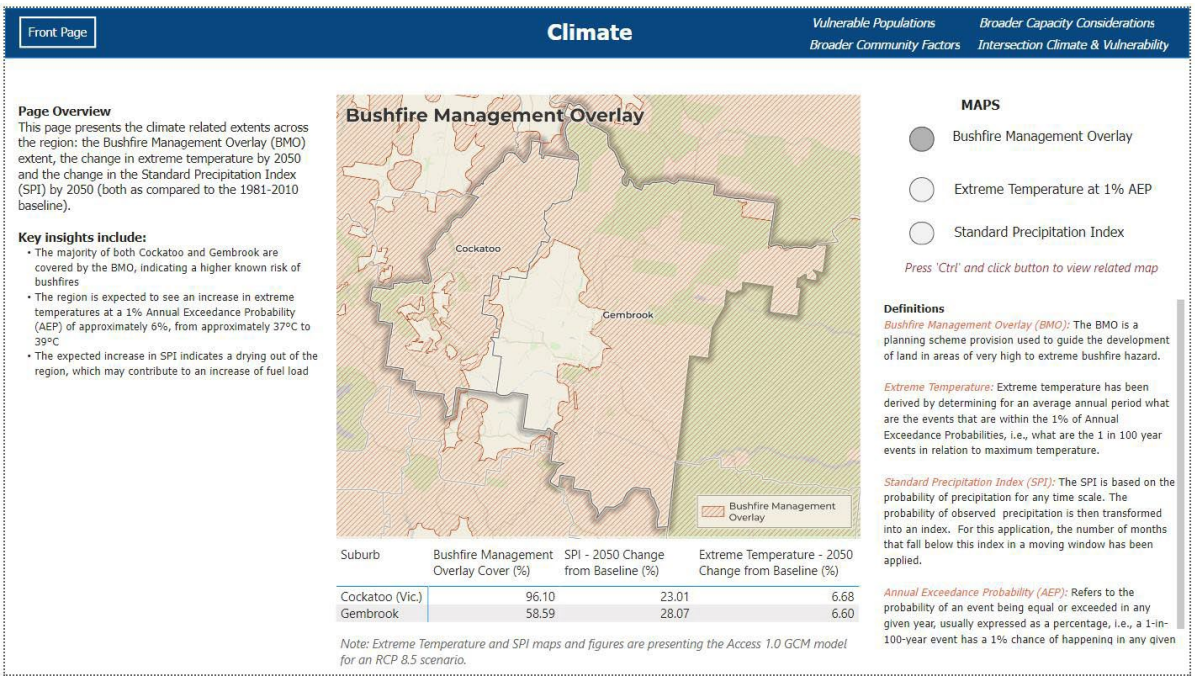

Figure 24. Gembrook and Cockatoo case study – climate page (with key insights).

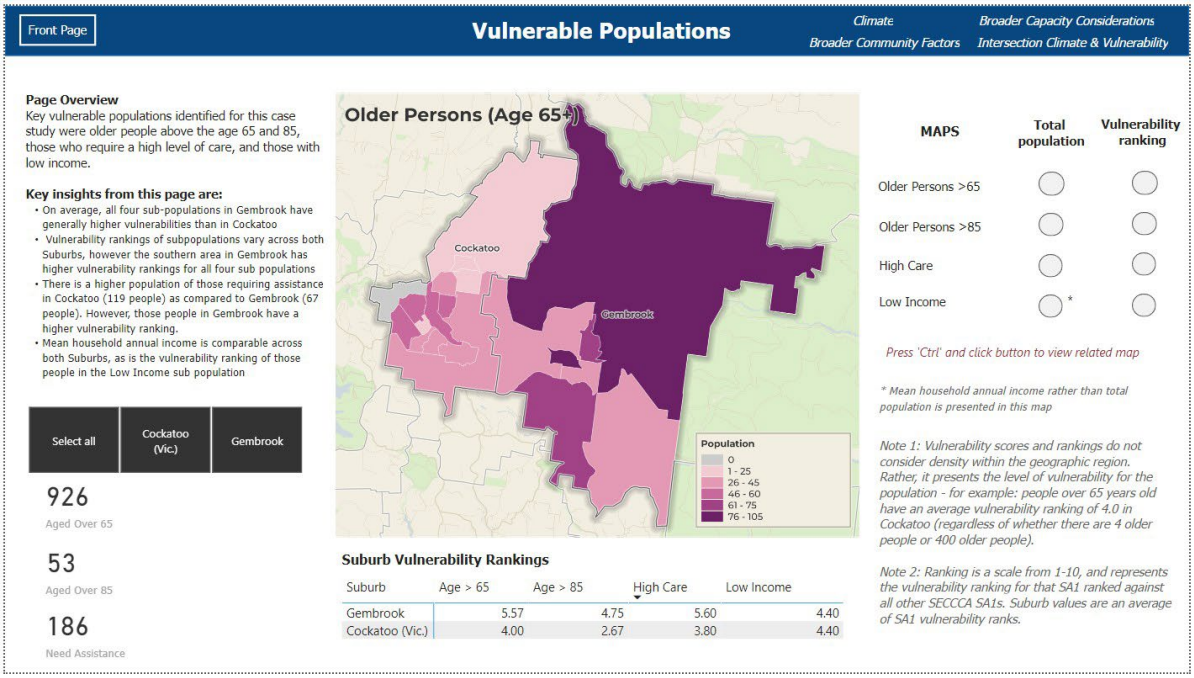

Figure 25. Gembrook and Cockatoo case study – vulnerable populations (with key insights).

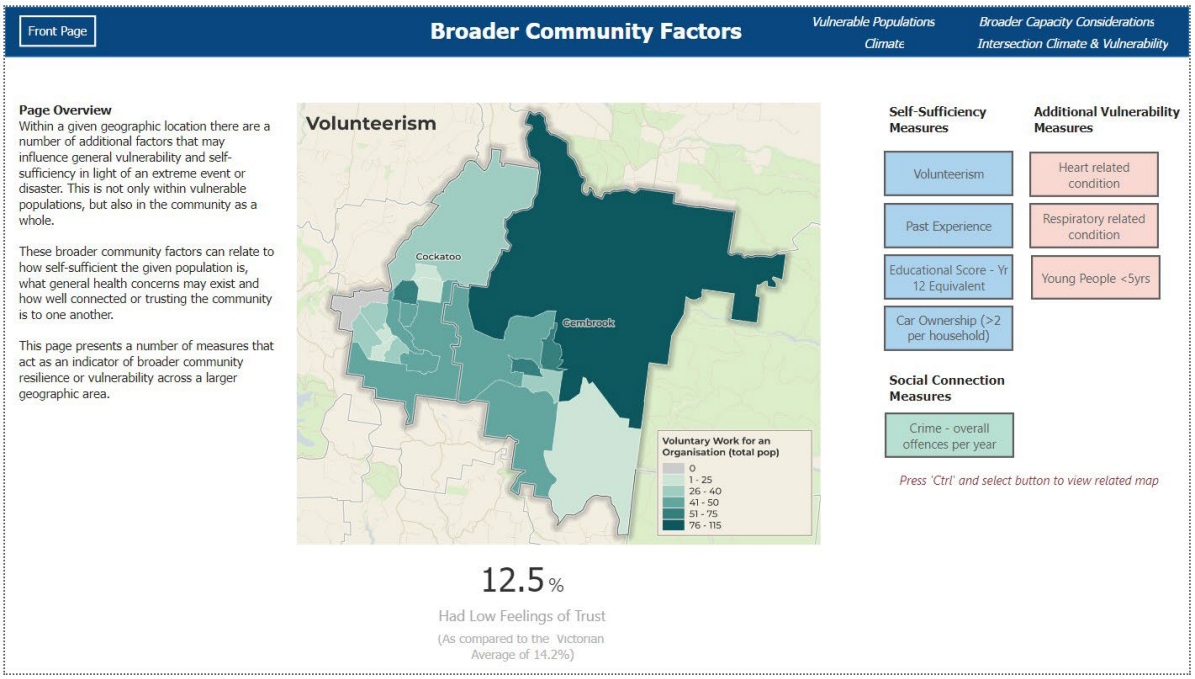

Figure 26. Gembrook and Cockatoo case study – broader community factors page.

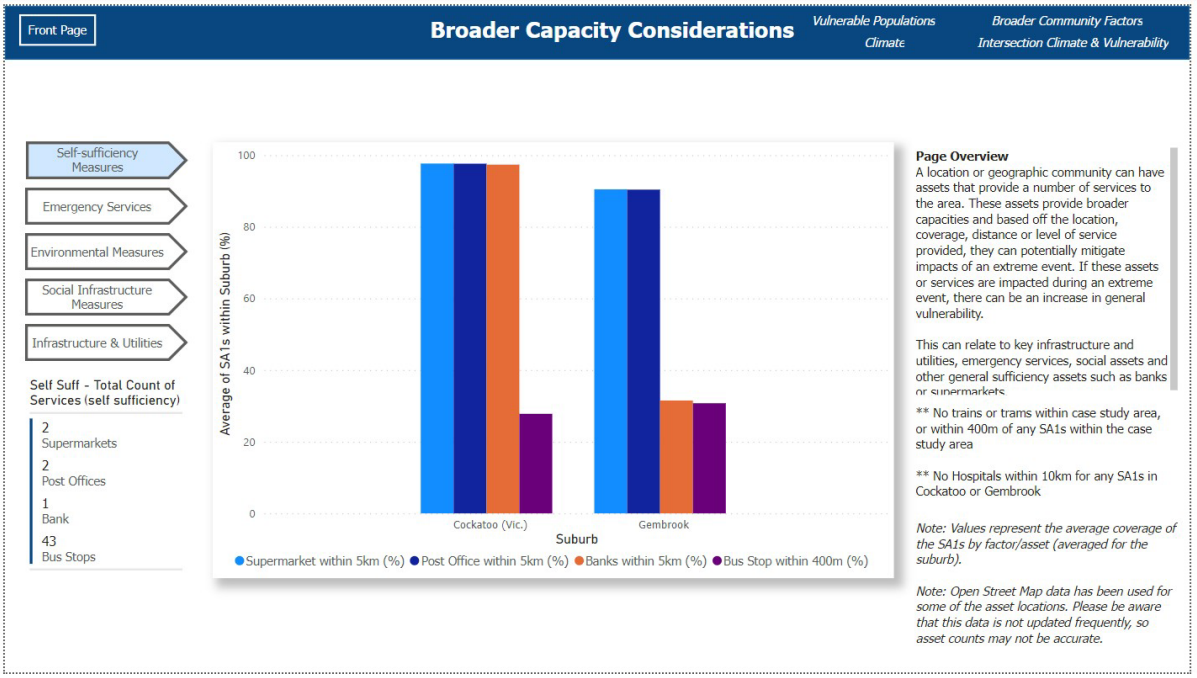

Figure 27. Gembrook and Cockatoo case study – broader capacity considerations page.

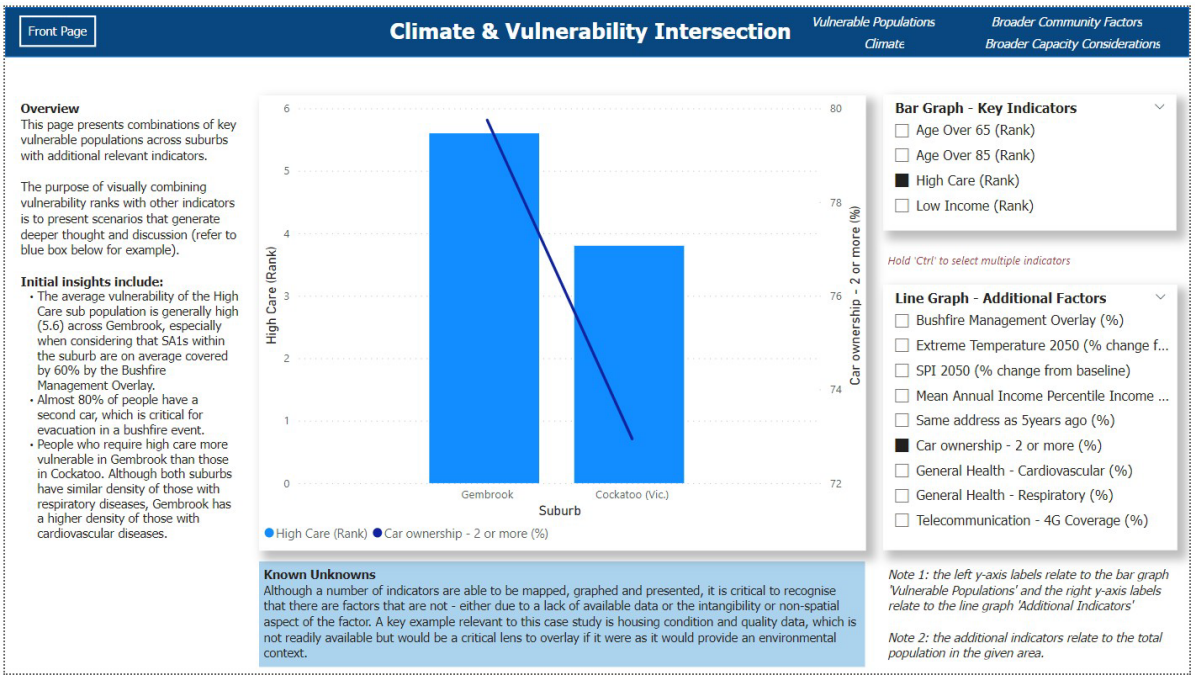

Figure 28. Gembrook and Cockatoo case study – climate and vulnerability intersection page (with key insights).

Appendix A: Acronyms

AEP	Annual Exceedance Probability
MS	Microsoft
NESB	non-English-speaking background
NSP	Neighbourhood Safe Place
SA1	Australian Bureau of Statistics Statistical Area Level 1
SECCCA	South East Councils Climate Change Alliance

Spatial Vision