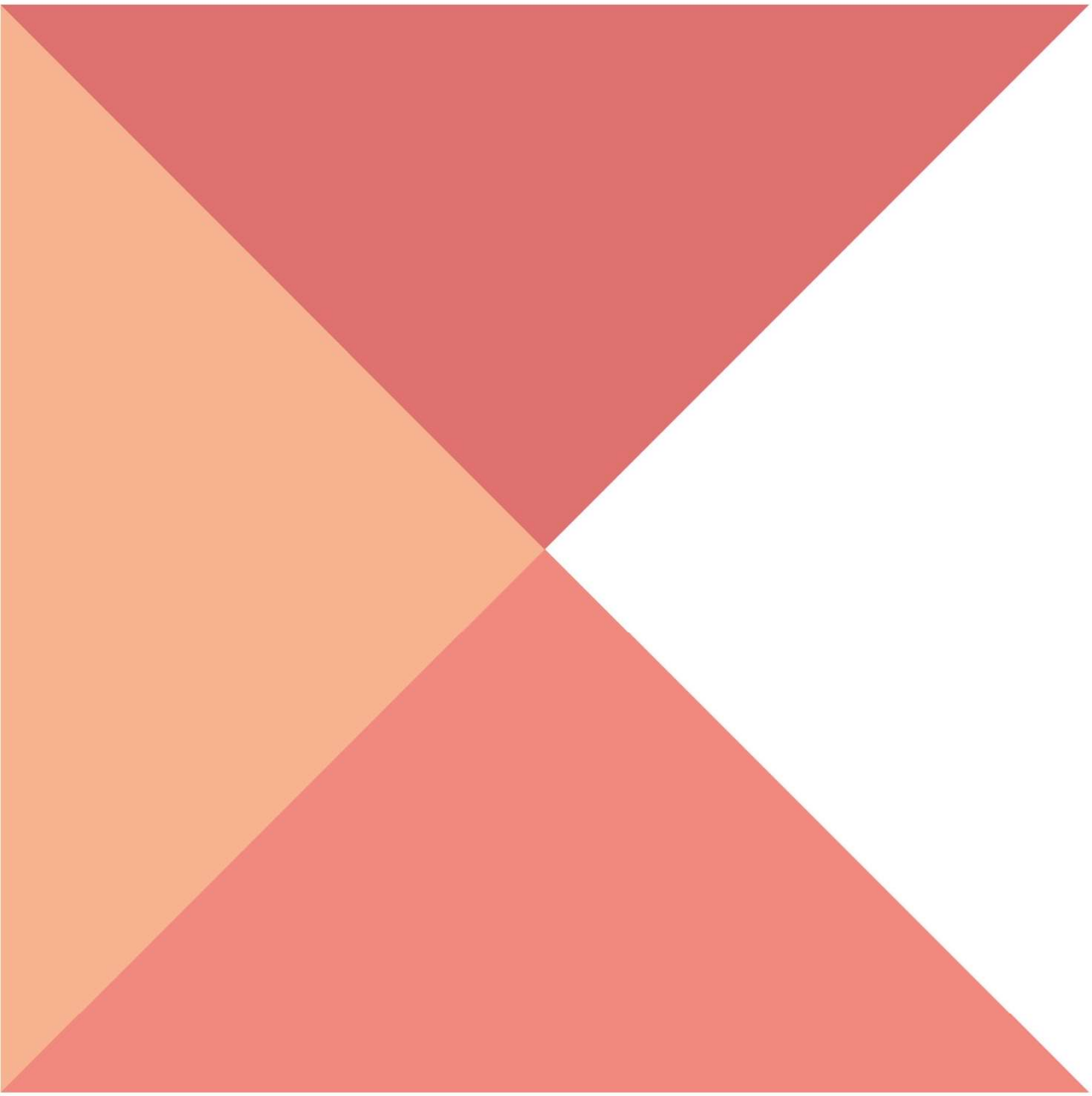
Regional Digital Plan

MALLEE



REGIONAL PARTNERSHIPS MALLEE

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Context of the Digital Plan

What is a Digital Plan?

The Digital Plan for each region is an evidence-based, place-based analysis of the supply of and demand for digital services and skills. It identifies 'unmet digital needs' across the region and potential solutions and makes a number of recommendations to relevant stakeholder groups including local, state and Commonwealth governments, industry and community groups.

The Regional Partnership will use this Digital Plan as the basis for advocacy on digital issues, engaging with relevant groups to raise awareness of the issues identified in the Digital Plan and to take ownership of and/or respond to the recommendations made. In this way the Digital Plan can bring about the changes needed to reduce the country-city digital divide. The Digital Plan can also support the efforts of individuals, businesses and community groups to better understand their local digital environment to support their own advocacy and activities.

The Digital Plans complement other regional Plans prepared by the Government to strengthen local economies and communities across regional Victoria – including Infrastructure, Transport, Skills and Growth Plans.

While informing the development of digital policies and programs for the regions, the digital plans are not a commitment to any particular course of action by the Victorian Government.

Why are Digital Plans needed?

The **digital divide**, where regional users face inferior digital services compared to their metropolitan counterparts, has been a longstanding issue affecting regional Victorians. The lack of comprehensive and comparable data on digital infrastructure supply and demand from place to place has been a critical barrier in the ability to clearly understand, advocate on and better target funding and initiatives towards the most pressing issues.

The Digital Plans are the most developed and comprehensive evidence-base ever produced on regional Victoria's digital infrastructure landscape. They will be a vital tool in effectively reducing the persistent country-city digital divide.

Addressing the digital divide matters more than ever as the realities of the increasingly pervasive digital world strike home:

Households around the world rely more and more on digitally-based communications, entertainment and shopping, banking, news and other personal services

Communities increasingly stay connected and safe, and community services are delivered more effectively, through digital platforms

Businesses of all sizes rely on digital advances – high bandwidth fixed and mobile communications, data capture and analysis, artificial intelligence and digitally-driven production techniques – to increase productivity and remain competitive.

How will the Plans be used?

The nine Digital Plans provide forward-looking guidance to Regional Partnerships, local governments and business, household and community groups in identifying digital priorities and advocating and developing solutions.

This Digital Plan will be:

- Used by the Regional Partnership as the basis for its actions and advocacy on digital issues, particularly in communicating the recommendations of this Plan to relevant stakeholder groups for their consideration, action and response

- Shared with local, state and Commonwealth governments to raise awareness of the digital issues affecting the region and assist in their own advocacy, policy and program development
- Shared with industry and local businesses to encourage them to identify and target investment to areas of highest need across the region
- Made available publicly for interested community members, households and businesses in the region and for other organisations keen to utilise this research and analysis for their own advocacy and activities.

How were the Digital Plans prepared?

Digital Plans were prepared on behalf of the Regional Partnership and supported by funding from the Connecting Regional Communities Program through:

- Extensive face-to-face consultation with the Regional Partnerships and Digital Plan Working Groups
- In-depth interrogation of the State Level Information Management (SLIM) database[1]
- Fieldwork comprising an online survey of all local governments in regional Victoria, and face-to-face interviews in each Region
- Independent expert advice on the fundamental drivers of unmet needs and potential solutions
- Confirmation from each Regional Partnership that the Digital Plan hits the mark as a tool for them and their stakeholders in driving place-based solutions to unmet digital needs.

Structure of this report

- **Section 1** - A summary of the report's key findings and recommendations as they relate to the following place and sector perspectives adopted by the plan:
    - Significant Places - the most populated cities, towns and localities of the region
    - Primary Production – a range of economically significant primary production sectors in the region
    - Tourism – a range of important tourist attractions / locations in the region
    - Transport Corridors - digital service availability along the region's key transport routes.
- **Section 2** – A detailed place- and sector-based analysis of digital services supply and demand analysis and a discussion of digital technology limitations, along with the Regional Partnership's recommendations for action.
- **Section 3** – The supporting evidence base underpinning the plan's analysis and recommendations including a description of the region's geographic, demographic, economic and structural change characteristics and an overview of current digital services in the region.

The intention is for this report to be used in a modular fashion depending on individual stakeholder interests. The general reader can focus primarily on **Section 1**, while others requiring more detailed information and evidence to support their understanding and activities can also refer to **Sections 2** and **3**.

[1] The SLIM database is an interactive place-based repository of current information on the availability of digital services and key demand drivers across regional Victoria

Regional Partnership Foreword

The Mallee Regional Partnership has now hosted three annual assemblies and there is one issue that has been raised consistently. Each year the call for better digital connectivity has been heard loudly and clearly.

Broadband services and mobile connectivity have the potential to increase our economic performance, reduce our costs, help us learn, provide us with services and improve social connectivity.

In a region that is characterised by the large distances between settlements, digital communications has the potential to overcome the 'tyranny of distance'.

Yet large parts of our region receive services that are inferior to more populous parts of Victoria.

As well as vast distances, the Mallee has a relatively small population. This means that it is unlikely that the Mallee will have the same standard of connectivity as is experienced in the CBD in Melbourne. However, we should expect to experience good connectivity where it is needed.

The Mallee Digital Plan provides us with a snapshot of the level of connectivity we have at present and recommends how we should improve upon the current situation.

I look forward to working with communities in the Mallee and with the Victorian and Australian Governments to realise our potential by ensuring we are better connected.

Winifred Scott
Chair
Mallee Regional Partnership

Executive Summary

Mallee is a large, sparsely populated, remote region bordered to the north by the Murray River which supports intensive horticulture sector, extensive sheep grazing on much of its landmass and some broadacre cropping in the region's southern reaches. The region's major population centre, Mildura (35,000 people) is over 500 kilometres from Melbourne. Mildura and Swan Hill (10,000 residents) support surrounding primary production activities, the rural hinterland and numerous small towns and localities.

Agriculture is the largest industry in terms of employment (15% of jobs), followed by health and community care services (13% of jobs and growing strongly) and retail trade (11%). Tourism provides 8% of employment. Agriculture and manufacturing both contribute strongly to Gross Regional Product – 25% and around 12% respectively. Both these sectors need to step up to a higher level of digital intensity over the next 5 years to ensure best practice efficiency and competitiveness.

Mallee residents living in Mildura, Swan Hill and in larger towns enjoy core digital services (broadband and mobile) on par with their Melbourne peers. Nonetheless the various dimensions of the digital divide – city-country, urban-rural, town-fringe and 'technology boundaries' within neighbourhoods – continue to limit attainment of the region's aspirations as a prosperous, enjoyable, secure and equitable place to live, work and do business. In particular:

- Fixed broadband connectivity does not meet the needs of many businesses across the Mallee due to technology limitations – the predominance of NBN FTTN in cities and towns limits the scope for uniform access to effective NBN business-grade services. In smaller localities, on the fringe of larger centres and in rural and remote areas, broadband for businesses is further compromised by the use of fixed wireless and satellite technologies
- The fixed broadband needs of households in smaller localities (less than 900 residents), on the fringe of larger centres and in rural and remote areas are also compromised by NBN fixed wireless and satellite technologies
- Mobile connectivity remains a high priority for regional users, with infrastructure investment and service quality below that of metropolitan users alongside ever-increasing expectations for on-demand access to voice and data functionality wherever users are. Major population centres appear to be well served but coverage and performance is unsatisfactory in many rural and remote areas and poor in-carriage mobile reception may occur on trains on the Bendigo to Swan Hill link. The public coverage maps underpinning this analysis are unable to show places within population centres where the 'lived experience' of mobile services is inadequate to support, for example, basic web-browsing, highlighting the need for better coverage data to guide future mobile infrastructure investment
- Limited low bandwidth Internet-of-Things (LP-WAN IoT) coverage exists for some cities, towns and primary production areas in the Mallee. While demand is currently moderate to low, coverage needs to be increased over the next 3-5 years for the adoption of next-generation business practices
- All tourism sites analysed have a major supply shortfall in fixed connectivity (important for providing the backhaul necessary for WiFi services), with four sites having an intermediate or major shortfall in mobile connectivity, noting reservations about the reliability and quality of mobile services even in locations assessed as adequate
- While there is a general perception the city-country digital divide extends to digital skills and affordability, systematic evidence is not available, making data collection a priority.

Priority actions to address the Mallee digital divide include:

Local Governments use their local presence, insights and planning powers to identify localised fixed and mobile blackspots, influence NBN high performance technology deployment, promote early 5G rollout and facilitate digital literacy training (possibly in local digital hubs)

The Victorian Government reviews and extends its regional telecommunications advocacy, co-investment funding and pilot programs[2]; works with network operators to improve coverage data; addresses location-specific unmet needs from targeted highspeed broadband deployment; facilitates regional IoT and 5G developments; and expedites access to the SLIM database by stakeholders in the region

The Commonwealth Government continues, reviews and extends its mobile blackspot co-funding program, requires NBN Co to maximise deployment of high-performance technologies and systematically reduce FTTN copper loop lengths, mandates industry meets stronger NBN service connection and maintenance requirements and invests in digital skills training programs

NBN Co restructures its wholesale pricing to allow lower retail prices and encourage greater utilisation of network capacity, and quickly brings to market effective business-grade services with strong service level agreements (SLAs)

The telecommunications industry actively considers opportunities to provide competing broadband services to businesses in high demand precincts, particularly if NBN Co fails to restructure its wholesale pricing or does not provide effective business-grade services.

[2] The Victorian Government has allocated $12 million to trial IoT connectivity for internet enabled on-farm technologies around Birchip (grains), Maffra (dairy), Tatura (horticulture) and Serpentine (sheep); $8 million for public WiFi pilots, originally in Ballarat and Bendigo and now extended to Shepparton and Geelong; and $7 million to pilot new higher-quality broadband networks in Morwell, Geelong and Horsham to to address gaps in the NBN.

SECTION 1 – Summary of Report Findings

This section provides a summary of the digital infrastructure gaps identified across the Mallee region and presents the Regional Partnership's recommendations which can address the **digital divide**: regional shortfalls in **access** to digital services, the **ability** to effectively use these services, and their **affordability** relative to their capital city counterparts. Further detail on these findings and the supporting evidence can be found in the following **Sections 2** and **3**.

The digital connectivity needs of businesses in towns, households, farms, tourist site operators and visitors differ across regional locations. As such, digital supply and demand analysis throughout this report includes an overlay of both places and sectors as follows:

- Significant Places – looks at the demand and supply of digital infrastructure and services in the most populated cities and towns with a selection of localities below 1,000 population in the region to identify where existing infrastructure is unable to meet current demand
- Primary Production – looks at the most economically significant primary production industries in the region, focusing on the availability of wireless technologies like NBN fixed-wireless, mobile and Low-Powered Wide Area Networks (that support Internet of Things applications like remote sensors) which are most relevant to primary production businesses
- Tourism – looks at the supply of and demand for digital services in the most important tourist attractions / locations in the region
- Transport Corridors – looking at the availability of mobile services along the region's key transport routes.

The other lens through which digital needs has been assessed is the technology type. The following technologies form the basis of the digital infrastructure analysis of the report:

- Fixed access – includes National Broadband Network (NBN) fixed-line broadband services including Fibre to the Premises (FTTP), Fibre to the Node (FTTN), Fibre to the Curb (FTTC), Fixed Wireless and Satellite
- Mobile – availability of digital mobile networks capable of supporting voice telephony and data applications through 4G networks (3G coverage is considered sub-standard)
- WiFi – the availability of public WiFi services such as through public libraries and buildings, information centres and other local government initiatives
- LP-WAN IoT – the availability of Low Powered Wide Area Networks that can support Internet of Things applications like remote sensors and devices which are becoming increasingly relevant to industry applications.

Further detail on these technology types is included in **Section 2**.

Overview of Key Issues

The extensive analysis and consultation undertaken in developing this Digital Plan has identified a range of digital issues across the region. Specific 'hot spots', places identified with inadequate digital services, are identified in the 'heat map' tables in the sections below. It is important to note that the analysis undertaken in this plan and outlined in the following sections provides a broad, representative snapshot of the current telecommunications landscape across the Mallee region. The analysis does not assess every aspect of digital connectivity, nor has it captured all population centres, tourist locations, primary production areas or transport corridors where there may be connectivity issues. However, the selection of places analysed provides a broad view of varying place and sector contexts which enables some general conclusions to be drawn, noting that further work may need to be undertaken to apply the analysis to other places. The general findings of the plan, and therefore priorities of the region, can be summarised as follows:

Need for better mobile access

There is a persistent and significant divide in the quality of mobile services available to regional users compared to metropolitan users with important implications for public safety, economic development and general liveability. Regional users have emphasised this issue recently, **registering 195 blackspots**[3] experienced across the region as part of the Commonwealth's black spot funding program.

The Mallee Digital Plan has necessarily relied on public mobile coverage maps provided by the carriers to undertake its analysis of mobile coverage. The analysis reveals the maps to be too high-level and low resolution to enable identification of localised areas where coverage is unreliable, weak and incapable of supporting the data services which users have come to expect to access 'on-demand'. This means that while an area may appear well-served by these maps, the 'lived experience' of regional users at particular locations is often very different. As such, throughout this Digital Plan, where a place or sector is assessed as having good mobile coverage based on public coverage maps, this should not be interpreted as saying there are not users in those places who face challenges with their mobile services both within that place and when they move beyond the place analysed. Better data in the future can provide a more complete picture about mobile coverage issues within towns and in areas not yet analysed by the Digital Plans.

Challenges in delivering a high standard of NBN infrastructure (that is, infrastructure better than FTTN) across the Mallee region increases the importance of good mobile connectivity including both voice and data functionality. As 5G mobile networks are deployed more broadly there is also an opportunity to better meet the needs of businesses and industries with this higher capacity mobile technology.

The Mallee Regional Partnership calls for continued Commonwealth and State funding to address mobile coverage issues and better data from carriers to enable more informed funding decisions. Commonwealth funding programs that target funding based on population density and premises covered disadvantage the ability of regions like Mallee to achieve the mobile coverage needed and expected by the community and businesses. While it appears none of the larger communities require systematic mobile blackspot attention, localities with populations below 1,000 people should be reviewed and mobile 'unmet needs' prioritised. The Regional Partnership plans to work with the Victorian Government to identify priority mobile blackspots in the region.

Lack of WiFi networks to support residents and tourists

WiFi for residents and visitors to reliably access the internet in low income areas is lacking, with five of the places analysed identified as facing either a major or intermediate supply shortfall: Merbein, Cohuna, Donald, Charlton and Sea Lake.

High quality public WiFi networks offer a valuable alternative form of connectivity in regional and metropolitan areas alike. Visitors and tourists can utilise these networks to stay connected in areas where they may not otherwise have coverage and to find information about services and attractions, ultimately increasing their time and economic engagement with a region.

Residents in the area can use the networks either as an alternative, potentially higher quality network than what is accessible at their premises, or for residents who may not be able to afford the data allowances they use. Public WiFi also supports students and local businesses with greater data capacity and alternative connectivity options.

The Regional Partnership has also identified public WiFi as a priority project for the region.

Poor services for primary production and tourism

The high-level picture for households and businesses in primary production areas and at more isolated tourist sites is of concern, with mobile coverage for farms and tourists lacking. There is also below-par fixed connectivity for farm offices and homesteads and tourist site operators potentially affecting economic outcomes for

[3] Based on the Commonwealth's *National Mobile Black Spot Database*, last updated October 2018

businesses in these areas. Patchy 4G mobile coverage along key transport corridors is another impediment to the tourism and hospitality sector, impacting the ability of visitors to search for and access local information on attractions and services. Better connectivity can increase the dollar spend of visitors to the region.

Low adoption of Internet of Things applications

The coverage of low bandwidth Internet-of-Things (IoT) networks for agriculture, logistics, delivery of "smart city" public services and other sectors is reasonable at the moment, but availability and knowledge of IoT applications and their value-proposition is limited. It is important for regional businesses to engage with these next-generation sensor-based business practices. Early adoption across the region can underpin productivity growth and competitiveness of our industries. If the current demand trend continues, we risk being left behind.

The Regional Partnership has identified IoT network deployment and agri-business IoT as a key priority project for the region.

Concerns regarding adequate NBN business-grade services

The availability of adequate, business-grade services for regional businesses across all NBN technology types (i.e. Fibre to the Premises, Fibre to the Curb, Fibre to the Node, Fixed Wireless and Satellite) remains a concern, despite the introduction of NBN's Enterprise Ethernet business service which may address the issue for user groups that have already been provisioned with the highest capacity NBN technologies.

Digitalisation of some industries will have a bigger impact on the region than others

Based on contribution to employment and Gross Regional Product, agriculture, health, construction and manufacturing are the most significant regional industries. Supporting increasing digitalisation of these industries will be critical for future productivity, competitiveness and growth for the region with a special emphasis needed on the digital skills required to support these industries in the coming years.

Digital divides within communities

Beyond the broad digital divide between metropolitan and regional areas, digital divides also exist within streets, suburbs and local government areas within the region. For example, where NBN infrastructure cuts over from fixed line broadband to fixed wireless technology, businesses and homes on either side of the technology boundary will experience different service quality. Understanding where these boundaries exist and how they adversely impact businesses in particular is an important economic development consideration.

Digital skills shortages

Secondary measures of digital skills needs and availability in the Mallee region have been used to give a perspective of the current skills landscape, including: age, education, the proportion of households that access the internet at home, the share of employment in high-technology industries and the 'ability' component of the Digital Inclusion Index. Together they suggest a significant skills shortfall in the Mallee region relative to Melbourne, and substantial differences between LGAs. Furthermore, at any location in the region, there will be individuals and businesses with low digital skills. Generally, the problem of digital literacy and skills availability is more intense the further the distance from a major population centre. This issue can have substantial impacts on future economic development as all aspects of life and business become increasingly digitised.

Further local data collection for primary measures of digital skills supply is a priority to identify skills gaps and shape needed remedial action.

Lack of competing broadband networks in regional areas

Competing networks capable of broadly-affordable business-grade service are in general not present in regional Victoria and are unlikely to be widely developed without government support. The rollout of 5G networks from 2019 onwards may help address this issue but is unlikely to be rolled out to any but the largest regional population centres in the near term.

Households are generally well served by existing services

Households in population centres down to quite small localities (500 residents) are generally well served with effective fixed and mobile connectivity and high bandwidth IoT coverage provided by the mobile carriers. However, it is difficult to reliably conclude what level of mobile service residents in an area receive based on the public coverage maps provided by carriers as noted above.

Increasing user expectations for mobile services

Mobile users have increasingly higher expectations of the services that they can access on smartphones. Once primarily considered a service for on-the-move outdoor use, mobile services are increasingly substituting for fixed services in the home and at work for a significant share of users emphasizing the need for high-quality and high-capacity mobile networks.

Identified infrastructure gaps

The sections below summarise the identified infrastructure gaps across the region according to a 'heat map' table that compares the supply and demand of digital infrastructure for Significant Places, Primary Production, Tourism and Transport Corridors. The colours in the maps should be interpreted as follows:

- Green = the supply of digital infrastructure is suitable to meet its demand
- Amber = there is an intermediate supply shortfall, for example where a place has a medium supply of a technology but a high demand
- Red = there is a major supply shortfall, for example where a place has a low supply of a technology but a high demand.

Section 3 includes the supporting evidence which has been used to undertake this analysis and develop the ratings. It brings together coverage data for digital infrastructure such as public coverage maps from mobile phone carriers and NBN Co, as well as demographic data for each place provided largely from Australian Bureau of Statistics census data such as median age, major employing industries and median income to estimate the level of demand for different technologies.

Also supporting the analysis is a newly developed data repository and visualisation tool, called the State-Level Information Management (SLIM) database, developed by the Victorian Government that aggregates digital infrastructure data across the state. This tool includes more detailed coverage data in some instances which is not yet publicly available, but which has been used to inform the analysis.

Supply for a technology type is rated high when the services available are similar to what is available across much of metropolitan Melbourne. For example, a high supply of fixed line broadband for businesses is regarded when there is FTTP or FTTC services available from NBN and/or the availability of competing networks to the NBN providing comparable services – supply for households is rated high where NBN FTTN is available. For mobile services, a location is considered to have high supply for both business and households where there are at least two network operators available in a location providing 4G services. As the quality and choice of services degrades in a place so too does the supply rating.

However, for mobile coverage analysis in particular it is important to note that the public coverage maps are not sufficiently detailed to ensure the real-world experience of mobile services in a given location is accurately reflected by the coverage maps. As such, mobile coverage analysis is a best-efforts attempt at reviewing the level of mobile coverage in a location and whether there are multiple carriers operating in a given location. A green rating in a given place does not imply all users are able to achieve good services, just that public coverage data suggests the area is relatively well covered by multiple providers. Technical limitations and the relatively lower levels of infrastructure investment in a given area in regional locations together combine to mean that the experience for regional mobile users is generally inferior to that in metropolitan areas, despite perhaps appearing well served according to public coverage maps.

Demand for a technology type is informed by independent expert advice about the current economic landscape and usage of digital services. **Fixed broadband** and **mobile service** demand is rated high across the board

reflecting the ubiquitous demand across households and businesses to be able to access these services whenever required to perform a range of activities. Demand by businesses for **LP-WAN/IoT** services in larger centres and for farms is rated medium, and low for businesses in smaller centres and households, both of which become higher in 3-5 years reflecting the rapidly increasing interest in IoT applications. Demand for **WiFi** is rated according to average income levels in a place, with lower income levels correlated with higher demand for the ability of these services to fill connectivity gaps for more disadvantaged residents.

Further detail on the heat map tables below and the analytic approach that underpins them is included in **Section 2**.

Significant Places Findings

Digital supply-demand balance for selected significant places is shown in Table 1, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- There are fixed broadband supply issues for businesses in all nine of the places analysed for business needs, highlighting a lack of adequate NBN business-grade services over the lower quality NBN connections like FTTN
- There are fixed broadband supply issues for households in six out of the 14 places analysed, generally being the smaller towns where NBN fixed wireless or satellite is the best service on offer
- Mobile access is generally good for the significant places analysed
- Although there is mixed coverage of LP-WAN / IoT networks, it is only identified as an intermediate issue in one location, reflecting the relatively low demand at present
- At present, supply of public WiFi is low in all places considered (with the exception of Ouyen), while demand is rated medium or high in five locations with below-average household incomes
- Further local data collection is required to identify skills gaps and support the analysis needed to determine if remedial action is required.

Table 1 Significant places: current unmet digital access needs.

Place	LGA	Name	User Type	Access			
				Fixed Supply / Demand	**Mobile*** Supply / Demand	**LP-WAN IoT** Supply / Demand	**WiFi** Supply / Demand
City	Mildura	**Mildura** (pop. 33,444)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Swan Hill	**Swan Hill** (pop.10,600)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
Town	Gannawarra	**Kerang** (pop.3,893)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Mildura	**Red Cliffs** (pop. 2,919)	Business	L/H	H/H	H/M	n.a.
			Home	M/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Swan Hill	**Robinvale** (pop. 2,154)	Business	M/H	H/H	M/M	n.a.
			Home	H/H	H/H	M/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Mildura	**Merbein** (pop. 1,981)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/H
			Community	n.a.	H/H	n.a.	L/H

	Gannawarra	**Cohuna** (pop. 1,866)	Business	L/H	H/H	L/M	n.a.
			Home	M/H	H/H	L/L	L/M
			Community	n.a.	H/H	n.a.	L/M
	Buloke	**Donald** (pop. 1,395)	Business	L/H	H/H	H/M	n.a.
			Home	M/H	H/H	H/L	L/M
			Community	n.a.	H/H	n.a.	L/M
	Mildura	**Ouyen** (pop. 1,045)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/M
			Community	n.a.	H/H	n.a.	M/M
Local	Buloke	**Charlton** (pop.961)	Home	H/H	H/H	L/L	L/H
			Community	n.a.	H/H	n.a.	L/H
	Swan Hill	**Lake Boga** (pop. 793)	Home	M/H	H/H	L/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Buloke	**Sea Lake** (pop 574)	Home	M/H	H/H	H/L	L/H
			Community	n.a.	H/H	n.a.	L/H
	Mildura	**Cabarita** (pop. 500)	Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Gannawarra	**Leitchville** (pop. 252)	Home	M/H	H/H	L/L	L/L
			Community	n.a.	H/H	n.a.	L/L

Legend **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

Primary Production Findings

Digital supply-demand balance for selected primary production areas is shown in Table 2, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- The Mallee region is characterised by vast, broadly distributed areas of agriculture and broad acre cropping. Six representative primary production areas were selected for analysis that provide an indicative rather than complete picture of digital connectivity for this sector of the Mallee region.
- There are fixed broadband supply issues for businesses and households in all primary production places analysed, reflecting the lack of quality fixed infrastructure in remote, sparsely populated locations
- Four of the six places analysed have an intermediate mobile supply issue for both households and businesses
- It is anticipated fixed access supply will change little in the next 3-5 years without policy intervention while demand continues to rise. The potential for 5G services to be offered that can address this shortfall is limited given the cost of delivering these networks to rural and remote areas.
- Low power IoT supply-demand balance is in transition – supply is predominantly reasonable (high or medium) relative to nascent demand but which is expected to rise substantially over the next 3-5 years.

Table 2 Primary production areas: current unmet digital access needs

Land Use	Location	User Type	Access		
			Fixed Supply / Demand	**Mobile*** Supply / Demand	**LP-WAN IoT** Supply / Demand
Fruits/nuts horticulture	Around Mildura	Business	L/H	H/H	H/M
		Home	M/H	H/H	H/L
	Around Robinvale	Business	L/H	M/H	M/M
		Home	M/H	M/H	M/L

	Around Swan Hill	Business	L/H	M/H	H/M
		Home	L/H	M/H	H/L
Dairy Grazing	Around Cohuna	Business	L/H	H/H	L/M
		Home	M/H	H/H	L/L
Grains Cropping	North of Birchip	Business	L/H	M/H	H/M
		Home	L/H	M/H	H/L
	West of Ouyen	Business	L/H	M/H	H/M
		Home	L/H	M/H	H/L

Legend **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

Tourism Findings

Digital supply-demand balance for selected tourism locations is shown in Table 3, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- Tourist sites include year-round attractions and periodic events such as music festivals
- Only fixed and mobile connectivity is relevant, as WiFi services for tourists must be supported through the fixed line connectivity of tourism operators
- All tourism sites analysed have a major supply shortfall in fixed connectivity, with four sites having an intermediate or major shortfall in mobile connectivity, noting reservations about the reliability and quality of mobile services even in locations assessed as adequate
- Looking forward 3-5 years, this pattern is expected to still prevail without intervention – it is unlikely market forces alone will sufficiently shift the supply fundamentals in more remote tourist locations even while demand is expected to rise in coming years with increasing live-streaming of events and growing tourist expectations for digital connectivity wherever they visit.

Table 3 Tourism areas: current unmet digital access needs

Type	Location	LGA	User Type	Access	
				Fixed Supply / Demand	**Mobile*** Supply / Demand
Permanent	Lake Tyrrell	Buloke	Operator	L/H	M/H
			Visitor	n.a	M/H
	Wooroonook Lakes Campground	Buloke	Operator	L/H	L/H
			Visitor	n.a	L/H
	Mount Wycheproof	Buloke	Operator	L/H	H/H
			Visitor	n.a	H/H
	Gateway to Gannawarra Visitor Centre	Gannawarra	Operator	L/H	H/H
			Visitor	n.a	H/H
	Kerang Lakes	Gannawarra	Operator	L/H	H/H
			Visitor	n.a	H/H
	Gunbower Island	Gannawarra	Operator	L/H	L/H
			Visitor	n.a	L/H
	Nyah Vinifera State Forest	Swan Hill	Operator	L/H	H/H
			Visitor	n.a	H/H
	Hattah Kulkyne National Park	Mildura	Operator	L/H	M/H
			Visitor	n.a	M/H
	Silo Art Trail	Yarriambiack	Operator	L/H	M/H

			Visitor	n.a	M/H
Events	Esoteric Festival	Buloke	Operator	L/H	H/H
			Visitor	n.a	H/H
	Big Cohuna Festival	Gannawarra	Operator	M/H	H/H
			Visitor	n.a	H/H
	Cullulleraine Music Festival	Mildura	Operator	L/H	H/H
			Visitor	n.a	H/H

Legend **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level. Outdoor coverage is considered to be generally sufficient for tourist locations.

Transport Corridors Findings

Digital supply-demand balance for selected transport corridors is shown in Table 4, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- Indicative analysis of mobile coverage (the only relevant technology here) was undertaken on a selection of roads and rail lines in the region to demonstrate the place-and-sector approach for transport corridors and note any preliminary patterns, noting the limitations of the public coverage maps relied upon
- While there is often some form of mobile coverage on many roads, the lack of continuous service greatly diminishes the value of coverage, with poor ability to utilize data services and voice services that drop in and out
- There appears to be reasonable mobile coverage on major (Class A) thoroughfares and significant (Class B) roads, with generally poor coverage on minor (Class C) roads, noting the limitations of the data available to provide a complete picture of service quality and continuity along roads that appear to be well served
- Mobile coverage of rail routes appears to be generally good, although in-carriage reception on the Bendigo to Swan Hill link is likely to be patchy on VLocity trains.

Table 4 Transport corridors: current unmet needs

Road Class	ID	From	To	Comment	Mobile* Supply / Demand
A	A20	Yamba	Mildura	4G coverage by at least two carriers	H/H
	A79	Mildura	Woosang	Continuous 4G coverage by one carrier only	M/H
B	B12	Pinnaroo	Tooleybuc	Limited 4G coverage	L/H
	B220	Ouyen	Tempy	Continuous 4G coverage by one carrier only	M/H
	B220 (2)	Woomelang	Cope	4G coverage by two carriers	H/H
	B260	Kerang	Macorna	4G coverage by at least two carriers	H/H
	B400	Robinvale	Gunbower	4G coverage by at least two carriers	H/H
C	All	37 roads		Patchy/low coverage	L/H
Rail		Melbourne	Bendigo	4G coverage by three carriers; good in-train reception	H/H
		Bendigo	Swan Hill	4G coverage by two carriers; uncertain in-train reception	M/H

Legend **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

Matrix of Recommendations

Contained throughout this report are a broad range of recommendations directed at actions the Regional Partnership will advocate and, in some circumstances, undertake, but also which fall into the responsibilities of other stakeholders, including local, state and Commonwealth Government, industry and community groups. The Regional Partnership will use this report to advocate to these stakeholder groups on the recommendations they should consider and act on to address the digital issues affecting our region.

The table below summarises these recommendations and indicates where a recommendation relates to one or more of the analytic perspectives adopted in the plan (i.e. Significant Places, Primary Production, Tourism and Transport Corridors) as indicated by the yellow boxes in the table. Where a recommendation is relevant to all, then it is of higher priority given its ability to make a difference to multiple place and sector perspectives.

The analysis in this Digital Plan has reviewed regional cities, towns and localities down to around 250 people. Further analysis will be required to understand the digital infrastructure characteristics of localities smaller than this and their most pressing 'unmet needs'.

RECOMMENDATIONS	**RECOMMENDATIONS RELEVANT TO:**			
	Significant Places	Primary Production	Tourist Locations	Transport Corridors
Based on this Digital Plan, the Regional Partnership will advocate for local governments in the region to:				
Use this Plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and identify the most appropriate way to address them.				
Educate those in sparsely populated locations that high-quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions (or possible relocation)				
Work with regional businesses to consider leveraging available government assets for cost-effective bespoke solutions				
Use the State Level Information Management database to conduct more detailed analysis of unmet needs and possible solutions				
FIXED ACCESS				
Work together and engage with NBN Co on their local rollout priorities and where network upgrade should be focussed when NBN Co is preparing to progress its network rollout in their localities, using the information in this report to inform priority locations				
Work with local businesses and community groups to better understand the incidence and impact of technology boundary issues (the 'have nots' next door to the 'haves'), and explore the feasibility of public network and bespoke solutions that address serious anomalies				
Consider obtaining quotes under the NBN Technology Choice program to upgrade existing or proposed NBN infrastructure where this does not meet the needs of their local business users or precincts and investigate				

funding models including contributions by precinct tenants				
Designate business precincts in greenfield locations that will be developed with higher grade connectivity (e.g. fibre-optic, high speed wireless), to create preferred locations for businesses critically requiring reliable high bandwidth				
MOBILE ACCESS				
Equip their vehicles with coverage monitoring tools to build a strong evidence base of blackspots in their LGA and work with the Victorian Government to include this and other ground-truthing field audit mobile coverage data in SLIM for use in future digital plans				
PUBLIC WIFI ACCESS				
Compile information on the location, footprint, target audience and use trends of their public WiFi networks, and their ambitions for wider WiFi coverage in their LGAs – to inform local government decision-makers and Victorian Government policy considerations				
The Regional Partnership recommends that the Victorian Government:				
Make available to Regional Partnerships, local governments and regional stakeholders the State Level Information Management database tool to conduct more detailed analysis of unmet needs and possible solutions for places and sectors not covered by this Digital Plan				
FIXED ACCESS				
Work with local governments and the Regional Partnership to promote competing provision of fixed broadband for businesses such as with the recent Enhanced Broadband projects taking place in Horsham and Morwell, particularly if NBN Co fails to offer effective business-grade services and reset its wholesale pricing.				
Develop a web-based application through which users could register their need for improved fixed (and other) access services.				
Make submissions to the current ACCC Domestic Transmission Capacity Services (DTCS) inquiry in relation to backhaul routes where its market insights indicate regional users are adversely impacted by high backhaul pricing.				
MOBILE ACCESS				
Advocate for mobile carriers to provide standard comparable coverage data that shows probable coverage and quality (e.g. areas where streaming, browsing, voice calls, emergency calls/SMS warnings are reasonably predicated to work – disclosure of 'real' performance) to better inform future black spot funding				
Work with local governments and Regional Partnerships, similar to the process for engaging with the Mobile				

Blackspots Program, to develop a 5G priority locations list and advocate to influence 5G rollout to these locations				
Commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas				
Develop a state-wide schedule of significant visitor events, in conjunction with Regional Partnerships and local governments, where network capacity problems exist and tender for a mobile operator to provide a solution.				
Examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas.				
IOT ACCESS				
Include IoT support as a decision criterion in mobile blackspot funding initiatives and advocate for the Commonwealth to do the same				
Pilot a low power (LP-WAN) IoT blackspot program and advocate for the Commonwealth to do the same				
Advocate for mobile carriers to provide standard geospatial coverage maps that include the type of IoT applications that are supported.				
Engage with mobile carriers and LP-WAN network operators on behalf of the Regional Partnership, local governments and business groups on their plans for IoT network deployments across the region and what information can assist to influence their rollout plans.				
PUBLIC WIFI ACCESS				
Work with local governments and the Regional Partnership to identify value-adding opportunities for public WiFi in smaller regional towns and localities to meet local social needs and attract visitors and examine public WiFi co-investment models such as the state or Commonwealth government meeting the capital costs and local governments (or carriers) meeting the operating costs.				
Fast-track the compilation and distribution of information on its public WiFi trials currently being conducted in Shepparton, Geelong, Ballarat and Bendigo				
SKILLS				
Allocate funding towards research that addresses the digital skills and service affordability information gaps				
Examine the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high-speed broadband access for those in NBN fixed wireless and satellite footprints)				

Examine the case for investing in the preparation and delivery of digital education and training, focusing the training across regions as more information on skills needs are revealed from further research.				
The Regional Partnership seeks the Victorian Government's support in progressing recommendations relevant to the Commonwealth Government and NBN Co by advocating on behalf of the Regional Partnership, noting the recommendations are likely to be relevant to other Victorian Regional Partnerships as well, warranting a coordinated Victorian advocacy approach.				
Specifically, the Regional Partnership seeks the Victorian Government's support to lead advocacy on the following recommendations to the Commonwealth and NBN Co:				
NBN Co to maximise the deployment of technologies with the highest performance potential in the remaining rollout areas – with assistance from local governments by highlighting areas where demand for high performance is expected to be greatest				
NBN Co to expeditiously introduce high-speed, business-grade NBN services, including symmetric high bandwidth services with strong service level agreements (SLAs) to regional areas				
Restructure NBN wholesale pricing to align retail service provider incentives with unlocking the maximum potential of the NBN				
Lowering of the threshold number of premises above which FTTP must be incorporated in greenfields developments				
NBN Co to implement stronger service connection and maintenance requirements for NBN services to underpin the service-related obligations that legislation imposes on RSPs				
The Commonwealth Government to continue investment in expanding mobile coverage				
The Commonwealth Government to include IoT support as a decision criterion in mobile blackspot funding initiatives				
The Regional Partnership recommends that the Commonwealth Government:				
Continue investment in expanding mobile coverage through the Mobile Black Spots Program				
Include IoT support as a decision criterion in mobile blackspot funding initiatives				
Pilot a low power (LP-WAN) IoT blackspot program				
Advocate for mobile carriers to provide standard geospatial coverage maps that include the type of IoT applications that are supported.				
Implement programs that can be applied to support public WiFi networks, building off the experience of Victorian pilot projects				

SECTION 2 – Detailed Issues Analysis and Recommendations

This section of the report elaborates on the findings and recommendations presented in **Section 1**. Further explanation of the rating methodology used in generating the 'heat maps' analysis is provided along with more detailed commentary about the findings.

The recommendations from **Section 1** are also included throughout this section within the discussion of technology limitations as well as the analysis for each place and sector lens of Significant Places, Primary Production, Tourism and Transport Corridors.

Summary

Analysis of digital supply and demand is conducted on a place and sector basis across the region to provide the evidence base necessary for effective digital planning. The map and table below capture high level findings for the Mallee Regional Partnership.

Mallee unmet needs hotspots: fixed broadband and mobile access

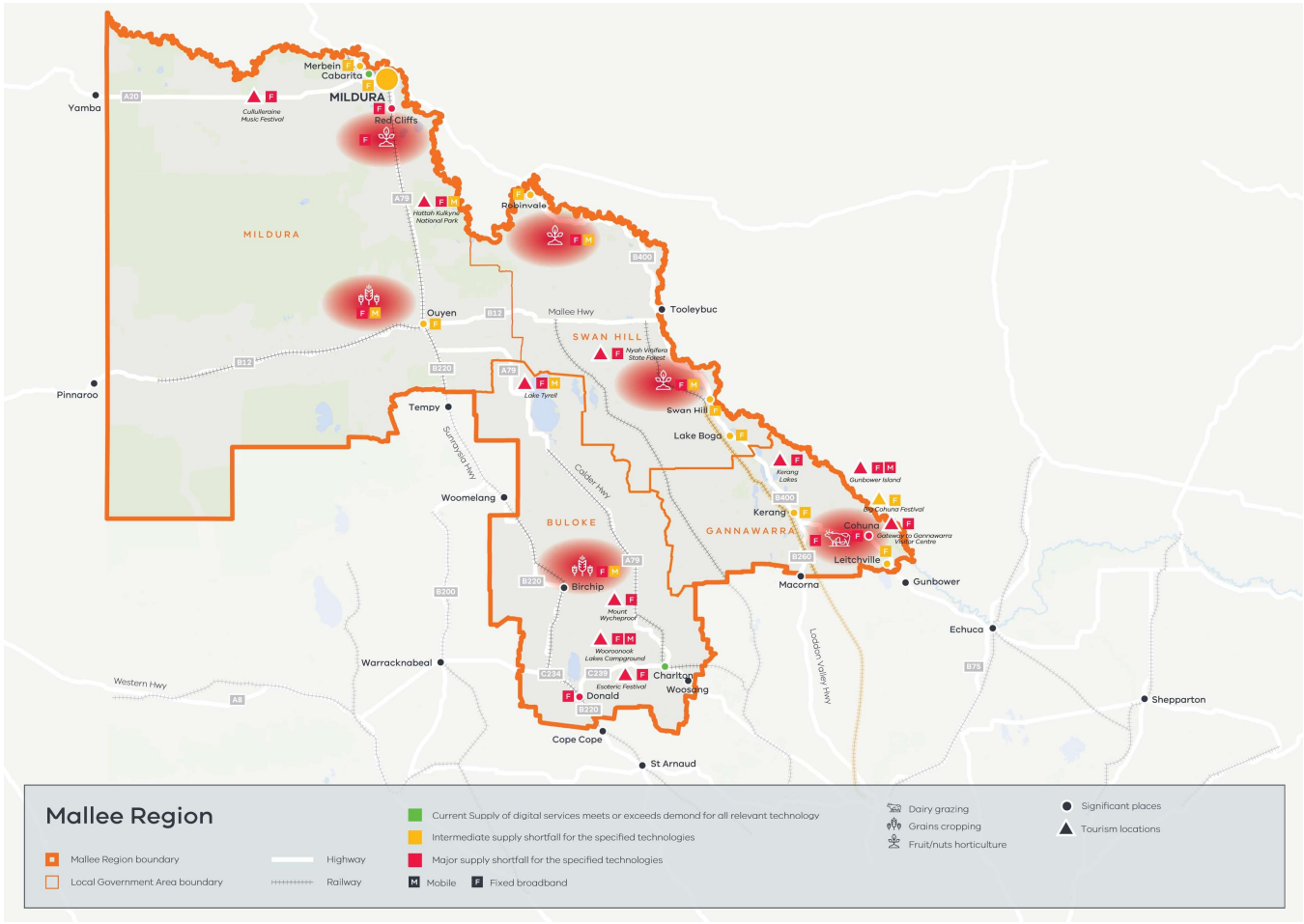

Figure 1 Mallee unmet needs hotspots: fixed broadband and mobile access

Table 5 Summary of common unmet needs for different regional user groups

Place/Sector (typology)	Demand Characteristics (place/user)	Digital 'Unmet Needs'
Significant Places		
Businesses	Concentration of public services (education, health, admin), retail, small business in cities, larger towns	Access to effective business-grade broadband, including on town fringes Improved digital skills
Households	High-medium population densities, suitable for NBN fixed line services	Access to affordable, high-capacity broadband Improved digital skills
Communities	Varying digital literacy & ability to afford broadband	Access to affordable broadband (including public WiFi) Increased digital skills
Primary production areas		
Farming	Low population density Variety of farming systems – broadacre cropping & grazing, intensive horticulture & livestock Increasing use of digital farming Varying digital literacy	Mobile coverage Customised solutions (e.g. on-farm WiFi) Broadband & narrowband IoT coverage Digital literacy – farmers, farm service providers
Tourist sites		
Permanent attractions	Both town & remote locations Visitors with high digital literacy & dependence (e.g. TripAdvisor, GPS, Facebook)	Mobile coverage Public WiFi – general and site-specific High bandwidth fixed broadband for WiFi backhaul
Events	Highly seasonal/periodic	Temporary mobile peak capacity requirements High bandwidth fixed broadband for WiFi backhaul
Transport corridors		
Road	Motorists & freight Mix of major (VicRoads) & minor (local council) roads	Continuous mobile coverage
Rail	Passengers Increased need for high quality mobile 4G (5G) connectivity	In-carriage reception on rail services between Bendigo and Swan Hill

Fixed Connectivity

Available fixed broadband connectivity does not meet the needs of many businesses across the Mallee region due to technology limitations – the predominance of NBN FTTN in cities and towns will limit uniform access to effective NBN business-grade services due to the technical limitations of this service. In smaller localities, on the fringe of larger centres and in rural and remote areas, broadband for businesses is further compromised by fixed wireless and satellite technologies. The fixed broadband needs of households in larger population centres are generally met at present, but the needs of households in smaller localities (less than 500 residents), on the fringe of larger centres and in rural and remote areas are compromised by having access only to NBN fixed wireless and satellite technologies.

Mobile Connectivity

Mobile coverage generally appears to be good in Mallee cities, towns and localities down to 250 residents, and on significant roads and rail links based on analysis of publicly available mobile coverage maps. However, we know

from consistent feedback and concerns of regional users that mobile service continuity and quality in many locations is a real concern. Undertaking the mobile coverage analysis as part of this plan has highlighted the lack of high-resolution coverage maps from carriers which show real-world performance (i.e. where coverage is capable of supporting only voice services or more data-intensive activities as well such as web-browsing and mobile applications). This issue is elaborated on below and highlights the need for better data from carriers to enable more informative analysis and identification of priority mobile blackspots in future iterations of this digital plan.

Mobile coverage and performance is unsatisfactory in many rural and remote areas and poor in-carriage mobile reception may occur on trains beyond Bendigo.

Limits to widespread remediation to these issues exist, as the per user costs of improving fixed line access and blanket mobile coverage rise exponentially with remoteness.

IoT Connectivity

Limited low bandwidth Internet-of-Things (LP-WAN IoT) coverage exists for some cities, towns and primary production areas in the Mallee. While demand is currently moderate to low, coverage needs to be increased over the next 3-5 years for the adoption of next-generation business practices.

In addition, there is the important and challenging issue of digital 'have nots' amongst the 'haves'. It is critical these 'below the surface' digital divide issues are not overlooked.

General Infrastructure and Technology Issues

Mobile network coverage

Mobile coverage (service availability) depends on local topography and the location and aerial orientation of mobile towers. Users closer to the fringe of a mobile tower's coverage will receive weaker signal strength and the lower population and revenue densities of regional markets and the larger areas in which people live means there is less mobile infrastructure in a given area compared to metropolitan areas. For these reasons mobile coverage is absent or poor quality in some regional locations.

This Digital Plan has, by necessity, taken the mobile coverage maps publicly provided by the carriers as the starting point for analysis – better data held by the carriers has not yet been made available. What this necessarily-superficial, second-best analysis does not show is the significant variation in the real-world connectivity experience of mobile users, with many gaps in coverage, and poor-quality service, in areas shown as fully covered.

Mobile users have increasingly higher expectations of the services that they can access on smartphones, ranging from traditional voice and critical emergency communications through to web browsing data apps and video streaming. The situations in which people want to access mobile services are also changing. Once primarily considered a service for on-the-move outdoor use, mobile services are increasingly substituting for fixed services in the home and at work for a significant share of users. However, the publicly available coverage maps fail to distinguish between traditional voice and other narrowband services on the one hand, and high quality mobile broadband access on the other – that is, they do not provide enough information for regional users in particular to identify locations where higher bandwidth services will (and will not) work well.

As such, while the analysis undertaken in this plan has led to many areas being regarded as well covered by existing mobile infrastructure, such conclusions need to be interpreted cautiously taking into account the limitations of the public coverage maps. Mobile coverage conclusions of this Plan are intentionally high-level and intended to offer the general perspective of a given city, town, primary production area, tourist location or transport corridor, rather than offering the perspective of individual users in these places who may be located on the fringe of coverage or an area where topography adversely impacts services in their area for example.

It is well understood by the Regional Partnership that even within the apparently well served areas many people will regularly face issues with access to reliable and high-capacity mobile services such as those available in metropolitan areas. Furthermore, as users move beyond higher density population centres between regional towns and into more remote locations there is inevitably a reduction in mobile coverage and the number of carriers providing good services in any given location. This is experienced by users as a lack of continuous, high-quality mobile services capable of supporting the full range of smart phone functionality users expect.

The Victorian Government understands user disappointment and disillusionment with mobile connectivity in regional areas and has joined industry stakeholders in calling for mobile carriers to publish the richer and more accurate coverage data they possess to accurately identify unmet needs and possible ameliorative actions. The Government in conjunction with the Australian Competition and Consumer Commission (ACCC) and the Commonwealth Government is actively pressing the mobile carriers to publish more useful coverage data and supports the ACCC in its public commitment to take regulatory action if cooperative progress is not made.

The SLIM database is capable of capturing and analysing more detailed location-specific information on the availability and quality mobile coverage in regional areas, with improved coverage data to be incorporated in future iterations of SLIM and the digital plans when this becomes available to enable mobile coverage analysis more closely aligned with the 'lived experience' of residents and visitors.

The Digital Divide – looking below the surface

The digital divide between regional Victorian residents, businesses and students and their capital city counterparts – the gap between them in the availability of digital services, the ability of residents and workers to use digital services (digital skills), and the affordability of digital services and digital expertise – is reflected in the RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) which measures these aspects in different locations. This shows a substantial gap between regional Victoria and Melbourne – rural Victoria rated 56 and Melbourne 65. The divide also exists within the region.

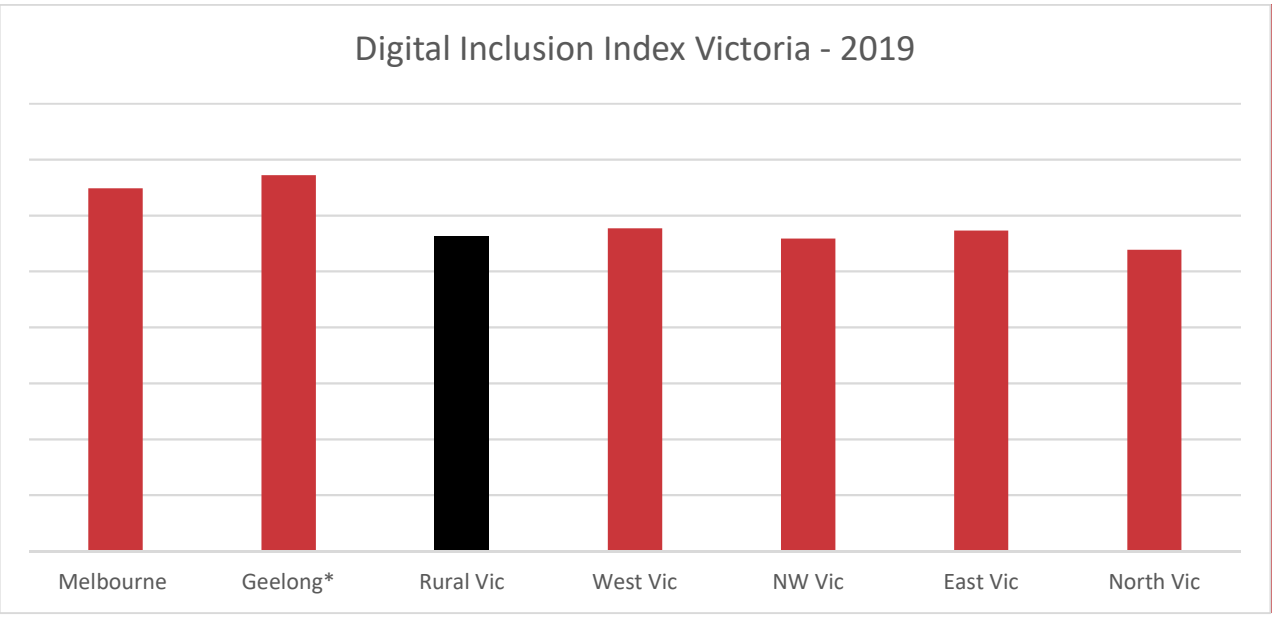

Figure 2 Summary of 2019 RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) findings across Victorian regions

*Sample size <150, exercise caution in interpretation Source: Roy Morgan, April 2018-March 2019

The significant diversity in geographic, demographic, social and economic characteristics within a region, and network design decisions and consequent technology boundaries, mean there are also digital divides within cities, towns, localities and rural/remote areas – digital 'have nots' amongst the 'haves'.

Where NBN infrastructure cuts over from fixed line to fixed wireless technology, or from fibre to the premise (FTTP) to fibre to the node (FTTN) within fixed line areas, businesses and homes on either side of the technology

boundary will experience different service quality. Similarly, local topology and antenna settings can result in substantial quality disparities in and between localities.

Furthermore, mobile users have increasingly higher expectations of the services that they can access on smartphones, ranging from traditional voice and critical emergency communications through to web browsing, data apps and video streaming. The situations in which people want to access mobile services are also changing. Once primarily considered a service for on-the-move outdoor use, mobile services are increasingly substituting for fixed services in the home and at work for a significant share of users.

Digital divides within communities and between businesses will also exist for digital skills and affordability, reflecting differences in individual and company digital proficiencies, age, income levels and experience in high technology environments.

Business-grade broadband services - NBN

Some regional businesses have experienced service quality difficulties with NBN fixed line services, in particular substantial variations over the course of the day in information rates achievable from NBN-based broadband services and have called for effective NBN business-grade services. The Victorian Government recognizes that from its inception in 2010 the mandated purpose of the NBN has been to provide ubiquitous highspeed wholesale broadband coverage to all residential (and very small business) premises at affordable standard national prices rather than larger businesses, and the necessity of NBN Co's technology choices to optimize total network costs. The Victorian Government also recognizes and applauds NBN Co for responding to the call from business of effective business-grade broadband services – high speed (100 Mbps+), symmetric and service level agreements on 24/7 information rate performance – for developing its Enterprise Ethernet business-grade service that meets these requirements for release Q4 CY 2018.

Nonetheless some unmet business needs will remain due to the predominance of fibre to the node (FTTN) technology within the NBN network which utilises long copper loops that will not support the Enterprise Ethernet service. There is no NBN business-grade service foreshadowed for fixed wireless areas, and there is uncertainty about the veracity of the yet-unspecified satellite-based NBN business-grade service due to inherent latency issues and information rate constraints.

Competing fixed broadband networks

Competing networks exist in capital city CBDs and some more densely settled metropolitan areas that can provide high quality alternatives to the NBN capable of supporting broadband services that meet the needs of digitally-intensive businesses at affordable prices. The existence of such competing networks leads to better service offerings for businesses and consumers in these areas.

The rollout of 5G wireless technologies as early as 2019 will enhance the capacity for alternative high-quality broadband services to the NBN to be provided. However, an equivalent situation does not exist in regional Victoria, where competing networks capable of broadly-affordable business-grade service are in general not present and are unlikely to be widely developed without government support.

Common technology issues

In developing the Digital Plans, numerous digital technology issues were identified through Regional Partnership and stakeholder consultation and expert analysis. Understanding the nature of these issues and the barriers which must be overcome is the first step towards addressing them and their impact on the digital divide. This section provides deeper insights into these problems arranged under six common themes that are most relevant to Victoria's regions:

1. **Fixed broadband**, in particular, the national broadband network (NBN).
2. **Mobile network coverage** – for both voice and data services. For some, this is an alternative to fixed broadband connectivity. For many, the "untethered" access made possible by the mobile networks is vital to social amenity, safety and productivity.
3. **Public WiFi** availability, particularly in low income locations.

4. **Low-powered wide area network (LP-WAN) coverage** and uptake for Internet of Things (IoT) applications. Embracing the application of IoT technologies is important if Australia is to achieve "best practice" in areas such as agriculture, community infrastructure and the like.
5. The potential to enhance outcomes by access to **Government infrastructure** – such as the optical fibre deployed along rail routes, and towers used for radio networks.
6. **Digital skills** – a vital counterpart to the availability of infrastructure and services.

The end of this section outlines a number of recommendations that can help to dismantle the barriers and accelerate progress.

Fixed Broadband

NBN Rollout Schedule concerns

With the NBN rollout still underway, some areas are already able to access NBN services while others are still waiting. Where a non-satellite technology is planned but the rollout has not yet been completed, users are generally not able to procure a satellite service in the interim, meaning their fixed broadband connectivity options remain as they were prior to the NBN initiative. These are generally an ADSL service over Telstra's copper, a non-NBN fixed wireless service, or a satellite service from a commercial provider.

For *most* (but not necessarily all) users, an NBN connection will deliver improved performance relative to the options previously available. Further discussion on where this may not be the case is provided in the following sections. While an improvement in fixed broadband services for many will come in the form of an NBN connection, the lengthy duration of the rollout schedule does mean that areas destined to be serviced in the final years of the NBN rollout face a measure of continuing disadvantage relative to those with access. While not possible to fast track the remaining rollout to all locations, it may (by negotiation with NBN Co) be possible to fast track the rollout to priority locations as identified by local governments.

Affordability and service quality concerns

The cost and quality of fixed broadband for regional users has been raised by stakeholders. Details (such as whether the complaints relate to NBN or other services, whether some RSPs feature more prominently than others, what retail plans are involved) are not available to support a comprehensive analysis of root causes. Some of the complaints relate to the type of connection available to them (see discussion later under "*Concerns raised around limitations of NBN technologies"*) and some relate the performance of services falling short of expectations.

For fixed broadband users, including those already able to access an NBN connection, a common complaint relates to service performance during peak periods – even for those users with the highest performing FTTP connection technology.

In the case of NBN-based services, two key segments in an end-to-end connection where performance may suffer during peak periods are the Connectivity Virtual Circuit (CVC) within the NBN, and the backhaul between an NBN Point of Interconnect (POI) and the RSP's core network. Both of these segments are "shared pipes" where the capacity available is a small fraction of the total demand that *could* be generated if all users were simultaneously active at the maximum speed available on their connection.

Towards strengthening the user's protection against poor performance, the Government passed legislation in mid-2018 setting out the user's remedies should the performance of an NBN-based service fall significantly short of nominal specifications advised by the RSP.

CVC Capacity

The under provisioning of CVC capacity is not due to technical limitations, but rather to a pricing model designed to boost NBN Co's wholesale revenues. In the early life of the NBN, RSPs typically acquired an *average* of just over 1 Mbps per customer (supporting users with connection speeds up to 100/40 Mbps). More recently, NBN Co has introduced pricing incentives to promote the purchase of additional CVC capacity, and at the time of this

report, the average had risen to a little over 1.5 Mbps. Nevertheless, congestion can still occur during peak periods.

Inadequate CVC capacity issues would typically affect both urban and regional users equally. However, due to lesser economies of scale, smaller Retail Service Providers (RSPs) may face higher costs in being able to provision adequate CVC to support their customers. Investing at the level required could lead to higher prices or inadequate margins – but failing to do so could leave their users more vulnerable to performance degradation during busy periods.

A CVC-based pricing model limiting the ability for smaller RSPs to compete in regional markets may contribute to inferior outcomes for regional businesses and households.

Backhaul Pricing concerns

The cost of backhaul for internet service providers to connect with the NBN points of interconnect (POIs) is higher in regional areas due to both the more limited backhaul infrastructure competition and investment, as well as the larger distances involved in connecting to POIs. The premiums attributable to regional backhaul may motivate RSPs to operate their links to regional POIs at higher congestion levels, with the result that regional users experience poorer performance than their urban cousins.

The cost of backhaul to core networks (almost always located in the major capital cities) is one of the barriers to more active competition for the supply of alternative fixed broadband services in regional locations and limits the growth of alternative business-grade networks.

Concerns raised around limitations of NBN technologies

Fibre-to-the-Premises (FTTP) represents the ultimate access technology, capable of performance limited only by the electronics driving the fibre. Whilst today's technology delivers 1 Gbps, 10 Gbps FTTP technology is on the horizon. Those serviced by the "lesser" technologies may face constraints on the utility of their connection as discussed further below (including access to effective business-grade services).

Greenfield housing developments present an area of opportunity for establishing FTTP precincts that can meet the needs of residential users with more demanding requirements. Currently, developers are required to procure a FTTP solution for any development comprising 100 or more dwellings.

As the NBN rollout proceeds and more fibre-based infrastructure becomes available throughout Victoria, the 100-dwelling threshold merits review. Consultation with regions suggests that lowering this threshold could improve the prospects of establishing FTTP enclaves in regional areas.

Satellite concerns

Satellite services are subject to latency issues which significantly affect the utility of these services, particularly for interactive activities requiring inbound and outbound signals. Geostationary satellite services can also be prone to disruption during periods of heavy rainfall and suffer predictable degradation twice a year due to solar interference.

The finite capacity of NBN Co's satellites is being rationed across the 3-4% of Australian premises that will eventually rely on the service. This constrains the ability to access retail high bandwidth broadband plans with as liberal monthly data quotas as are typically available on terrestrial connection technologies. This can be an impediment to utilising these services for more data intensive activities such as large-scale data sharing for farming and mining, online education and streamed entertainment. For large-scale agricultural users it is also not possible to use NBN satellite services out in the field as the service needs to be "anchored" to a fixed location, usually the house.

Fixed Wireless concerns

NBN Co utilises fixed wireless (FW) to a maximum distance of 14 kilometres from the base station. Installations at the limits of this reach may experience some variability in signal quality. The current maximum speed is 50/20

Mbps. NBN Co had signalled its goal of introducing a 100/40 Mbps offering, but no recent announcements have been made as to if and when this will become available.

Fixed wireless technologies share the finite capacity of an antenna beam amongst all of the users in the footprint of that beam. As such, the network is prone to congestion during busy periods. In October 2018 NBN Co acknowledged a problem of congestion on around 4% of FW sites, reducing busy-time performance to below 6 Mbps per user.

Fibre to the Node (FTTN) concerns

The performance of services supported by FTTN technology is heavily influenced by the length and condition of the copper segment from the node to the customer's premises. While distances of up to about 150 metres support speeds of or close to 100/40 Mbps, a majority of users are located at longer cable distances from the node, leading to progressively slower performance. In August 2017, NBN Co disclosed the percentages of FTTN-connected premises in different download speed bands as follows:

- 6% in the 12-25 Mbps band
- 29% in the 25-50 Mbps band
- 33% in the 50-75 Mbps band
- the remainder (32%) in the 75 -100 Mbps band.

Business and household users connected by FTTN technology that are too far from the node to support the higher speed tiers offered over the NBN may be constrained in their online activities and commercial potential (including access to effective business-grade services).

To put this issue in some perspective, NBN Co's 2018 Annual Report indicated that some 52% of NBN FTTN users were selecting plans with download speeds of just 12 or 25 Mbps – achievable on virtually all connections. Affordability (and the adequacy of such speeds for those with modest needs) is undoubtedly a factor for many who choose these plans. However, there are also likely to be some who would opt for higher speed plans if their lines were capable of supporting them.

The individual Digital Plans for each Regional Partnership go some way in identifying locations (such as business precincts) where the NBN technology may limit current or future digital progress. Better information on where these demand hotspots exist can support more targeted and efficient investment and upgrades to NBN services.

Early signs from the CRCP Enhanced Broadband program emphasises the reality of these technology boundaries and the impact on regional communities. Several enhanced broadband pilots are being undertaken to ascertain the appetite among regional communities for services beyond those being provided by the NBN, with alternative service providers demonstrating interest in bidding for these projects. The department will be happy to provide feedback and outcomes from these pilot projects as they become available to shed light on the business model feasibility of NBN bypass and assist the Commonwealth and NBN Co in considering where and how upgrades to the NBN rollout can be best applied to meet local community needs.

The situation for "digitally intensive" businesses is somewhat different from that of residential users. Discussions with regional stakeholders exposed several situations where large businesses with demanding connectivity were suffering from the lack of adequate, competitively-priced solutions, ideally over optical fibre. Such businesses and locations could be prioritised for NBN upgrades or policy attention given to procuring competitively-priced fibre access in regional locations.

NBN Connection and Fault Repair Experience

The parliamentary Joint Standing Committee on the NBN released its first report on 29 September 2017. The Committee recommended that appropriate consumer protections be established for broadband services, including service connection and fault repair timeframes, minimum network performance and reliability, and compensation arrangement when required standards were not met.

Strong Service Level Agreements (SLAs) are especially important to businesses, since service disruption and protracted outages have the potential to bring the businesses to its knees.

Alternatives to NBN Connections

The carriers offering fixed broadband alternatives to the NBN tend to be most active in urban areas. Under its agreement with NBN Co, it is understood that Telstra is not permitted to compete with NBN Co for residential connections once a cabled NBN solution (FTTP, FTTN, or FTTC) is established in an area. However, it is able to offer business-grade services to organisations needing more specialised connections.

An important consideration is ensuring that the organisations which depend on high-speed connectivity for the conduct of their businesses are able to procure the services they need. This underpins the rationale for Victoria's Enhanced Broadband program as part of the CRCP. Cabled solutions that involve the installation of new cabling over any significant distance will typically be priced at a level that only the very largest of businesses could entertain.

One of the options for moderating costs is to establish precincts that can accommodate a cluster of businesses with high connectivity needs.

1. Mobile blackspots

In the context of mobile connectivity, the overwhelming issue of concern to regional Australians is gaps in coverage.

Real world experience of mobile coverage indicates that the situation is far more complicated than the coverage maps provided by the mobile network operators suggest. Mobile phone users in regional areas frequently report weak signals and call drop-outs in areas that are claimed to have good coverage. It is an unfortunate reality that mobile coverage cannot be accurately summarised in a simple form because of a number of complicating factors:

- networks are constantly evolving, and new sites are periodically commissioned
- connectivity depends on the quality of antenna in the receiving device
- device reception can be enhanced by use of an external antenna
- a large number of environmental factors can be at play, including local complex topography blocking or reflecting signals (known as 'multi-path'), vegetation along the path (especially if it is moist) and adverse weather such as rain, fog or dust
- signal strength can vary widely as users move around closely proximate locations (for example, when moving from open space into or near a building).

Any given tower can support a mix of technology generations (such as 3G, 4G and in the near future, 5G) at different frequencies (various channels from 700MHz to 2600MHz and higher for 5G). Both the phone and the network continually negotiate the connection and need to adapt for changes in real-time, especially for devices that are actively moving during a call or download. All of these factors combine to deliver an experience that is often well short of what the coverage maps would suggest - and significantly worse than that experienced by metropolitan users.

Connectivity can also fail or degrade due to tower congestion when a large number of users all try to connect at the same time – for example, at an event or a passing bus/train in a remote area.

Blackspots continue to be an issue affecting not only public safety and social amenity, but increasingly business efficiency. Almost every sector of economic activity is evolving to exploit the opportunities that have become available with anywhere, anytime access to information and services via the mobile networks. Without mobile connectivity, individuals and businesses will find themselves at growing disadvantage.

With large geographic areas of Victoria destined to be limited to satellite for fixed broadband services, the mobile networks can provide a valuable adjunct, fallback or alternative to fixed broadband – providing low latency connections and providing a "safety net" when satellite services are affected by solar interference or severe weather conditions.

The Digital Plans for individual regions are expected to note conspicuous gaps in mobile coverage that affect:

- significant places (population centres and tourist locations)

- road and rail transport routes
- areas of agriculture or other areas of intensive economic activity.

Whilst accepting that 100% landmass coverage is not a realistic goal, it may be sensible that an appropriate national mobile coverage aspiration should be established reflecting worthwhile socio-economic benefits from extending coverage further in regional Australia, most of which cannot be captured by the MNOs.

A "natural monopoly" may be the most efficient approach for providing coverage in areas of very low population density requiring significant public subsidies. This could take various forms, such as:

- concentrating future investment in one carrier, but on condition that the carrier offers mobile roaming to other MNOs; or
- establishing a wholesale-only operator in the areas where no other MNO will go, with that operator providing roaming to all MNOs. e.g. NBN Co or a new special purpose private or government-owned entity.

Rail coverage

A significant community of mobile users travel along the various rail corridors across Victoria, both for commuting and as tourists. The importance of good coverage for train travellers is recognised by the Victorian Government's investment partnership with the main MNOs and V/Line to improve in-carriage coverage along the five main commuter rail corridors out of Melbourne. Similar to the experience of road users, train travellers frequently report poor experiences in areas where the MNOs suggest that they provide good coverage due either to localised mobile blackspots or carriage types that block passenger in-carriage reception.

Disparate coverage

Because the network footprints of the three MNOs differ, there are many locations where users of one mobile network have no coverage, but where coverage is available on one or both of the other two networks. Such situations rarely occur in urban areas.

This is not a problem for emergency calls, since triple-zero (or "112") calls will be accepted on any network. However, for users wanting to maximise network access for more general purposes (both calls and data access), the only option is to maintain multiple network subscriptions – adding to costs and creating ambiguity for callers.

The introduction of mobile roaming between carrier networks is a potential solution to the problems of a disparate patchwork of coverage. While not favoured by the ACCC at present, a change in the approach for blackspot funding towards a natural monopoly could prevent the problems of disparate coverage in very low population density areas from growing.

Major events capacity shortfalls

At significant regional events mobile coverage is not just required to support attendees and their needs for connectivity, but also increasingly for vendors who are reliant on 3G/4G coverage for EFTPOS terminals handling onsite payments. This is particularly important in (for example) swap-meets, markets and field-days where significant amounts of money change hands. A lack of connectivity can be crippling for business.

Potential approaches to alleviate problems with capacity shortfalls include:

- Coverage Augmentation. This may be applicable to venues that are regularly used, and which warrant a permanent boost in capacity through the deployment of micro-cells.
- WiFi Coverage. Providing a public WiFi zone covering the area in which the event is conducted may allow a proportion of the demand (notably for data) to be offloaded from the mobile networks, freeing more capacity for voice communications.
- Demand Aggregation. Compiling a consolidated State-wide schedule of all events where additional mobile capacity is needed could underpin a procurement process from the MNOs to satisfy the requirements.

2. Public WiFi

Virtually all modern smart phones, tablets and notebook computers have the inbuilt capability to connect to WiFi networks. WiFi is therefore a highly accessible connection means supporting faster connection speeds avoiding some of the costs associated with transferring high data volumes over mobile networks. However, the range of WiFi signals is quite limited (indicatively 100 metres) and therefore multiple base stations are necessary when attempting to provide coverage over a larger area.

Free WiFi zones (open to public use) have been established in various locations throughout regional Victoria. In developing the individual regional plans, interest in Public WiFi zones has been reinforced to address a range of needs:

- as a means of access for under-privileged households in the community who may not be able to afford fixed or mobile connectivity
- for visitors and tourists who want to find out information about their location and/or share experiences with family and friends
- for travellers passing through an area
- for residents living in regions where the only fixed broadband option is a satellite service, or when away from their fixed broadband connection.

3. Low Powered Wide Area Network (LP-WAN) Connectivity (IoT)

IoT investment is forecast to grow dramatically over the coming years. Whilst still in a relatively early stage of development, IoT technology will increasingly underpin “best practice” in many areas of economic activity and presents opportunities that Australians will need to embrace if they are to remain competitive with global markets.

Some IoT applications are well established, such as the remote camera surveillance for security purposes. Many other IoT applications are still in a developmental phase – trialling different approaches and learning what works and what doesn’t work.

On the supply side, there are numerous different technologies that can be used to connect devices – including Bluetooth and Zigbee. However, four LP-WAN technologies – NB-IoT, LoRa, Sigfox and Taggle - are emerging as key pillars of support for emerging IoT needs. These technologies vary in performance characteristics, the distances over which connectivity can be achieved and power requirements. For many applications, batteries are the only viable source of power to sensors and battery life of 10-15 years can be a key requirement.

NB-IoT is an extension of the mobile networks, with coverage being provided by the existing mobile networks. For the other three technologies, coverage is currently being deployed on an “as needed” basis. That is, coverage is not being deployed in advance of commercial opportunities, but rather in response to specific projects that generate revenue to fund the infrastructure.

Given that IoT is a relatively new phenomenon, demand for LP-WAN coverage is emerging but can be expected to grow strongly in the coming years. A key factor will be the extent to which various barriers to adoption are overcome. These barriers may include (but are not limited to):

- lack of end-to-end solutions that can be implemented without specialised systems integration experience
- lack of network coverage for the particular connectivity technologies used by available solutions
- insufficient proof of the benefits on offer through IoT technologies to attract end-user investment
- a shortage of appropriate skills and experience to support the implementation and operation of beneficial applications
- costs – either capital costs associated with implementation, or ongoing costs associated with connectivity or the operation of solutions.

A range of IoT trials in the agricultural sector are being funded as part of the Victorian Government's CRCP and are expected to yield valuable insights into factors that can accelerate adoption. Suggested approaches to boosting the uptake of IoT technology are expected to be determined in the wake of this work.

4. Alternative infrastructure

Various infrastructure providers have deployed optical fibre or other communications technologies to support their operations. Spare capacity is often available that could be made available for other purposes without compromising the host agency's use. However, the availability and capacity of these alternatives is not well known.

Discussions with stakeholders indicated a low level of awareness of the potential for utilising spare capacity on alternative infrastructure. Notwithstanding the lack of overt demand, there are a number of areas in which such capacity could be used to advantage including (but not limited to):

- providing additional backhaul capacity between NBN Co's regional POIs in Victoria and the central RSP networks in Melbourne
- providing backhaul capacity for enhanced broadband precincts and carriers offering alternatives to NBN services
- (in the case of towers) supporting microwave links that address critical gaps in high-speed infrastructure.

5. Digital skills

Little systematic place-based information on the supply of and demand for digital skills and the affordability of digital services was available to support development of the Digital Plan. This is a clear barrier to deeper understanding of where digital skills issues are prevalent and potential remedies to address them. However, some broad findings and conclusions can be drawn about the current state of affairs.

The extent to which digital literacy is a problem across the regions varies considerably. As a broad generalisation, the problem is more intense the further the distance from a major population centre. It is likely that this relates to the reduced access to education and training resources, potentially setting up a vicious circle.

The character of needs varies from introductory computer literacy (often the foundation for kick-starting more advanced learning) to sophisticated skills of the kind needed to exploit more specialised opportunities.

A rich array of educational resources is available through the Internet. Many of the most effective are video-based – ranging from video clips explaining how to solve particular problem (such as on YouTube) through to streaming webinars (commonly offered through industry groups) and lectures (both streamed live and stored for consumption at the user's convenience). Many are freely available (for example, the massive online open courses, or "MOOC"s). Some of the more advanced courses culminating in formal accreditation involve enrolment and the payment of fees.

For many regional Victorians, connectivity is still a barrier to taking advantage of these resources – whether due to connectivity costs, low-speed connections or limited data quotas that can be quickly exhausted if video resources are used too liberally. Accordingly, improving the general connectivity landscape via the sort of measures outlined in the earlier sections of this submission can help to improve access to learning resources and contribute to higher digital literacy.

Improving connectivity more generally (both fixed and mobile) can also serve to make regional Victoria a more attractive location for businesses and individuals, decentralising the population distribution and improving the market for supporting industries (such as IT equipment supply and maintenance etc.).

Notwithstanding general improvements to the connectivity landscape, it is predictable that a sector of the community risks being left behind in an increasingly digital world. The most digitally vulnerable include those who:

- cannot afford either fixed or mobile connectivity

- live outside mobile coverage areas
- have connectivity that performs poorly or is subject to restrictive data usage quotas (for example, users in the NBN satellite footprint).

For some such individuals, access to public WiFi can provide an alternative, even if it lacks the convenience of anytime access and requires travel to a point of access.

In general, it is anticipated that the future will bring improved local options for raising digital literacy (including tuition in digital hubs), state-wide vocational training solutions for shortages of IT professionals, and state-wide school education solutions (STEM++) for digital age workforce preparedness.

Digital learning needs to start with baseline skills so that people can find and engage with more advanced materials. Access to foundational education needs to be effective and affordable. Beyond basic literacy, the digital access infrastructure and services documented in the regional digital plans potentially alert users to various resources that can be used to remediate skills shortages – for example, using YouTube, MOOCs (massive online, open courses), and interactive training providers. Education is likely to be most effective when embraced at the local level. Multipurpose digital hubs can play an important focal point in this regard, including good online access and venues where, for example, young people can teach older citizens and workers basic digital literacy skills.

In addition to generic educational resources, further detailed work may expose key gaps that could be usefully addressed with tailored training modules, or potentially a “roadshow” of presentations.

The following summarises some key factors relevant to the success of digital hubs identified through consultation with representatives from three regional digital hubs as part of the Digital Plans’ case study development. These include for hubs to:

- have a clear, well-defined purpose
- feature a multi-function, flexible layout, be aesthetically inviting, safe and adaptable to all sectors of the community
- be well-managed and well-supported from information technology, communications and specialised equipment perspective
- provide learning activities and programs that are well-targeted to the needs of the surrounding community
- establish and maintain a program of support volunteers.

Recommendations

Fixed access recommendations

Recommendation 1:

Local Governments should work together and engage with NBN Co to communicate their local rollout and upgrade priorities when NBN Co is preparing to deploy or upgrade infrastructure in their localities, using the information in this report as a guide to priority locations.

Recommendation 2:

The Victorian Government should encourage the Commonwealth Government to require NBN Co to maximise the deployment of technologies with the highest performance potential in the remaining rollout areas. Local governments can assist by highlighting areas where demand for high performance is expected to be greatest.

Recommendation 3:

Local Governments should consider obtaining quotes under the NBN Technology Choice program to upgrade existing or proposed NBN infrastructure where this does not meet the needs of their local business users or precincts and investigate funding models, including contributions by precinct tenants.

Recommendation 4:

Building a solid evidence base detailing significant gaps between supply and demand would position the Victorian Government to guide future NBN upgrade activities to the areas of greatest need. Developing a web-based application through which users could register their need for improved fixed (and other) access services could assist in this regard.

Recommendation 5:

The Victorian Government should advocate to the Commonwealth and NBN Co for a lowering of the threshold number of premises above which FTTP must be incorporated in greenfields developments.

Recommendation 6:

The Victorian Government should advocate to the Commonwealth and NBN Co to review NBN wholesale pricing to improve affordability of high-speed services and help in unlocking the full potential of Australia's investment in the NBN. Ideally any restructuring would include a reduction in the artificial performance constraints created as a result of CVC pricing and low-speed connection options.

Recommendation 7:

The Victorian Government and regional stakeholders should make submissions to the periodic ACCC Domestic Transmission Capacity Services (DTCS) inquiries in relation to backhaul routes where local market insights indicate regional users are adversely impacted by high backhaul pricing.

Recommendation 8:

The Victorian Government should advocate for NBN Co to expeditiously introduce high-speed, business-grade NBN services, including symmetric high bandwidth services with strong service level agreements (SLAs) to regional areas

Recommendation 9:

The Victorian Government to advocate for NBN Co to implement stronger service connection and maintenance requirements for NBN services to underpin the service-related obligations that legislation imposes on RSPs.

Recommendation 10:

Local Governments should designate business precincts in greenfield locations to be developed with higher grade connectivity (e.g. fibre optic, high speed wireless), to create preferred locations for businesses critically requiring reliable high bandwidth.

Mobile access recommendations

Recommendation 11:

Local Government agencies consider equipping their vehicles with coverage monitoring tools to build a strong evidence base of blackspots in their LGA.

Recommendation 12:

The State Government should commit to further funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas, and advocate for the Commonwealth to do the same.

Recommendation 13:

The State Government should develop a state-wide schedule of significant visitor events, in conjunction with RPs and local governments, where network capacity problems exist and tender for a mobile operator to provide a solution.

WiFi access recommendations

Recommendation 14:

The State Government, working with local governments and regional partnerships, should identify value-adding opportunities for public WiFi in smaller regional towns and localities to meet local social needs and attract visitors. Co-investment models (such as State or Commonwealth funding) should be explored to meet capital costs, with local governments (or carriers) meeting the operating costs.

IoT access recommendations

Recommendation 15:

The Victorian Government should include IoT support as a decision criterion in mobile blackspot funding initiatives and advocate for the Commonwealth to do the same.

Government infrastructure recommendations

Recommendation 16:

Local governments and regional businesses should consider leveraging available government assets for cost-effective bespoke solutions (for example VicTrack fibre for backhaul or interconnecting access network components).

Digital skills recommendations

Recommendation 17:

The Victorian Government should explore the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high broadband access for those in NBN fixed wireless and satellite footprints) subject to strong local support and a credible plan for ensuring their sustainability.

Recommendation 18:

The Victorian Government should examine the case for investing in the preparation and delivery of digital education and training, focusing the training across regions as more information on skills gaps are revealed from further research.

Rating Methodologies

Fixed access rating methodology

Reflecting the needs of users relative to service quality provided by different fixed and mobile technology types and the situation in metropolitan areas, the following rating standards have been used.

SUPPLY

For businesses

Rated High where:

- Mainly FTTP or FTTC (as these technologies can deliver the forthcoming Enterprise Ethernet business-grade service), AND/OR
- There are one or more competing networks providing comparable business-grade services at similar prices to NBN business-grade service

Rated Medium where:

- Mainly FTTN (as users face uncertainty about the availability of the forthcoming Enterprise Ethernet service at a premise as this service cannot be provided over access long loops), AND
- There are no alternative networks offering comparable business-grade services at similar prices

Rated Low where:

- Mainly fixed wireless (as no fixed wireless business-grade service in the pipeline, FW service only available up to 50 Mbps and FW information rate can be significantly degraded when network use spikes), OR
- Mainly satellite (as there is no specification available for the mooted business-grade satellite service, latency issues are inherent and current satellite services are only available up to 25 Mbps and there are data limits), AND
- There are no alternative networks offering comparable business-grade services at similar prices

For households

Rated High where:

- NBN FTTP, FTTC or FTTN are available (as this is comparable to the metro household situation), AND/OR
- There are one or more competing networks offering 100 Mbps+ service at comparable prices to NBN

Rated Medium where:

- NBN fixed wireless is available, AND
- There are no competing networks offering 100 Mbps+ service at comparable prices to NBN

Rated Low where:

- Only NBN satellite is available, AND
- There are no competing networks offering 100Mbps+ service at comparable prices to NBN

DEMAND

Demand for fixed access by businesses and households is rated High as both groups need fixed line network performance to meet their current and emerging digital needs.

Mobile access rating methodology

Local accuracy of mobile coverage analysis is limited by the need to use high-level publicly available mobile coverage maps. Government discussions with mobile network operators to enable access to more detailed information are occurring. In addition, local "ground-truthing" of mobile coverage will be included in future updates of the Digital Plan.[4]

SUPPLY

For both businesses and households (as access to quality mobile services is very important for both groups):

Rated High where:

- Two or more 4G networks are available

Rated Medium where:

- Only one 4G network is available

Rated Low where:

- There is no coverage by any mobile network, OR
- The only coverage available is predominantly 3G

DEMAND

Demand is rated High for all mobile users now and in 3-5 years, reflecting mobile's importance for all.

Narrowband (LP-WAN) IoT access rating methodology [5]

SUPPLY

The present supply of LP-IoT is rated:

- High for near-complete coverage by at least one LP-WAN network
- Medium or Low for patchy or no coverage
- At least two networks requirement for High in 3-5 years.

DEMAND

Demand by businesses in larger centres and for farms is rated Medium at present and High in 3-5 years; and Low (now) and Medium (3-5 years) for businesses in smaller centres and households, reflecting an explosion in IoT interest and use.

[4] Note that decisions on Victorian government funding for mobile blackspots is not based on the high-level mobile coverage maps it is necessary to use in the digital plans

[5] Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the Plan analysis as this information is not publicly available. High bandwidth and 2-way IoT are provided by mobile carriers.

Public WiFi

SUPPLY

Supply of public WiFi is rated:

- High where it is available in relevant public places and disadvantaged localities
- Medium or Low for incomplete or no coverage
- For now, and in 3-5 years.

DEMAND

Demand by residents is rated according to income levels (high where incomes are low), reflecting the importance of mobile access to everybody for everyday life.[6]

[6] This broad measure could be improved by using more detailed information on disadvantaged locations from the ABS Socio-economic Index (SEIFA) and the Jesuit Social Services study *Dropping of the Edge: 2015* (postcode level)

Significant Places Analysis

Digital supply-demand balance for selected population centres is shown in Table 6, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about the good coverage indicated by public coverage maps.***

Table 6 Significant places: current unmet digital access needs

Place	LGA	Name	User Type	Access			
				Fixed Supply / Demand	Mobile* Supply / Demand	LP-WAN IoT Supply / Demand	WiFi Supply / Demand
City	Mildura	**Mildura** (pop. 33,444)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Swan Hill	**Swan Hill** (pop.10,600)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
Town	Gannawarra	**Kerang** (pop.3,893)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Mildura	**Red Cliffs** (pop. 2,919)	Business	L/H	H/H	H/M	n.a.
			Home	M/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Swan Hill	**Robinvale** (pop. 2,154)	Business	M/H	H/H	M/M	n.a.
			Home	H/H	H/H	M/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Mildura	**Merbein** (pop. 1,981)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/H
			Community	n.a.	H/H	n.a.	L/H
	Gannawarra	**Cohuna** (pop. 1,866)	Business	L/H	H/H	L/M	n.a.
			Home	M/H	H/H	L/L	L/M
			Community	n.a.	H/H	n.a.	L/M
	Buloke	**Donald** (pop. 1,395)	Business	L/H	H/H	H/M	n.a.
			Home	M/H	H/H	H/L	L/M
			Community	n.a.	H/H	n.a.	L/M
	Mildura	**Ouyen** (pop. 1,045)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/M
			Community	n.a.	H/H	n.a.	M/M
Local	Buloke	**Charlton** (pop.961)	Home	H/H	H/H	L/L	L/H
			Community	n.a.	H/H	n.a.	L/H
	Swan Hill	**Lake Boga** (pop. 793)	Home	M/H	H/H	L/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Buloke	**Sea Lake** (pop 574)	Home	M/H	H/H	H/L	L/H
			Community	n.a.	H/H	n.a.	L/H
	Mildura	**Cabarita** (pop. 500)	Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Gannawarra	**Leitchville** (pop. 252)	Home	M/H	H/H	L/L	L/L
			Community	n.a.	H/H	n.a.	L/L

Legend **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

Commentary

Fixed access supply in Mallee cities and larger towns is currently favourable for households, but under par for businesses as the prevailing NBN FTTN technology will not uniformly support effective business-grade services and alternative NBN-equivalent broadband services are not available. The situation is less favourable for small towns and localities where NBN fixed wireless prevails. Mobile access is generally good for the 14 Mallee places examined (recognising coverage issues at specific sites). Coverage of narrowband IoT networks across Mallee places is mixed but in general not constraining as demand is also low at present. The supply of public WiFi is low across the region, not meeting latent demand in places with below-average household incomes.

Looking forward 3-5 years, while government advocacy, demand aggregation and co-funding programs for fixed network upgrades may be effective at the margin (guided by the CRCP enhanced broadband trials), widespread fixed access upgrades will be difficult to achieve due to network cost constraints. Furthermore, 5G mobile coverage in smaller locations may lag demand.

Fixed access

Fixed access for cities and towns with population in excess of 1,000 residents, is predominantly provided by NBN FTTN technology. While this satisfactorily meets current household needs (on par with metropolitan households), it represents an intermediate supply shortfall for businesses as FTTN will not uniformly support the pending NBN Enterprise Ethernet business-grade service due to long loop lengths for some premises. For some smaller towns and localities NBN fixed wireless is the prevailing network technology, meaning an intermediate supply shortfall for households and major shortfall for businesses as the NBN business-grade service will not be offered on its fixed wireless network.

Looking forward 3-5 years, while NBN FTTP FTTC networks would support future business demand for business-grade services, widespread upgrades will however be difficult to achieve. Nonetheless government advocacy, demand aggregation and co-funding programs for enhanced broadband may be effective at the margin for smaller population centres, guided by lessons from the CRCP enhanced broadband trials in Morwell and Horsham.

Mobile access

Mobile access according to public coverage maps from carriers appears to be good for all the Mallee cities, towns and localities examined (down to 250 residents) with near-complete 4G coverage by at least two carriers (recognising there will be specific sites which experience unsatisfactory mobile performance). The light green shading for mobile coverage analysis in the heat map tables in these sections reflect the concerns regarding the veracity of these conclusions based on the best-available publicly data used.

However, the 3-5 year outlook is uncertain, as only the larger population centres may receive 5G coverage (based on carriers targeting large and rapidly growing populations). Importantly, the introduction of 5G services will at some point create greater competition between mobile and fixed access providing a potential solution for individual premises and neighbourhoods with poor fixed access.

Narrowband (LP-WAN) IoT [7]

While coverage of narrowband IoT networks across Mallee cities, towns and localities is currently mixed, demand by businesses, local governments and households is also low with little apparent unmet need at present.

Looking forward 3-5 years - IoT network coverage is expected to increase substantially, driven by rising demand and the relatively low cost of low bandwidth IoT networks and applications (use of low-cost spectrum and long signal carrying distances). Demand developments are less clear – while there is widespread expectation that IoT

[7] Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the Plan analysis as this information is not publicly available.

use will burgeon in the near future, what is not apparent is whether these largely premise-specific business and household IoT needs will be met by in-premise WiFi systems coupled with fixed backhaul or by public IoT networks.

Public WiFi

A key benefit of free public WiFi at present is assisting disadvantaged residents access the internet, and for visitors to the location. At present supply of public WiFi is low in all places considered (with the exception of Ouyen), while demand is rated medium or high in the five locations with below-average household incomes. Accordingly, based on the methodology and limited data used, there appears to be an unmet need for public WiFi in some mid-sized and smaller locations.

Looking forward 3-5 years - It is expected some local governments will roll out public WiFi in public places and disadvantaged neighbourhoods in response to these and their own "smart city" unmet needs. This suggests a potential role for targeted Commonwealth and State government programs – with the current CRCP free public WiFi trials in Shepparton and Geelong providing useful lessons on the design of such programs. However, falling mobile data prices, and scope for mobile networks to support low power Smart City sensors may mean public WiFi becomes less relevant for social and local government service delivery purposes. Monitoring of trends is required.

Skills and affordability

Primary measures of digital literacy, availability of IT professionals and workforce preparedness for the future digital world, including on a place and sector basis, are extremely limited, existing at best at a high level of aggregation. As a result, further local data collection is required to identify skills gaps and shape needed remedial action. Nonetheless there are a range of secondary indicators that, taken together, give a broad indication of skills availability (supply) at an LGA level – age, education, the proportion of households that access the internet at home, the share of employment in high-technology industries and the 'ability' component of the Digital Inclusion Index. Based on these broad indicators, there appears to be a significant skills shortfall in the Mallee relative to Melbourne, and substantial differences between LGAs. Furthermore, at any location in the region, there will be individuals and businesses with low digital skills.

Looking forward 3-5 years, workforce preparedness for successful employment in the digital age is important for the whole of Victoria, with shortfalls in regional areas likely to be greater than in Melbourne given lower education levels and older populations. The importance accorded digital skills apparent from the digital plan consultations highlights the need for data collection on skills supply and demand.

Affordability of digital services has not been considered in the Digital Plan analysis and warrants attention in the next generation Plan.

Recommendations

Recommendations lie primarily with regional stakeholders (local governments, business and community groups and the Regional Partnership), including encouraging and assisting the Victorian Government make evidence-based representations on needed changes to the Commonwealth Government, NBN Co and other digital service providers. These are listed in the Matrix of Recommendations in **Section 1** above. Some of the actions are high-level and general in nature such as establishing priorities and action plans, while others are technology-specific or focused on skills gaps and affordability. They address both broad shortfalls in the supply of digital services and skills and their affordability, and the frequent situation of 'have-nots' amongst the 'haves'. The recommendations outlined address current and future unmet digital needs.

The Mallee Regional Partnership high level recommendations for Significant Places include:

1. Local governments to use this Plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and identify the most appropriate way to address them
2. Local governments and the Regional Partnership to educate those in sparsely populated locations that high-quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions
3. Local governments and regional businesses consider leveraging available government assets for cost-effective bespoke solutions
4. Victorian Government to make available to Regional Partnerships, local governments and regional stakeholders the State Level Information Management database tool to conduct more detailed analysis of unmet needs and possible solutions for places and sectors not covered by this Digital Plan
5. Advocate for the Victorian Government to explore the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high broadband access for those in NBN fixed wireless and satellite footprints) subject to strong local support and a credible plan for ensuring their sustainability.

Specific recommendations include:

Fixed access

1. Local governments engage with NBN Co to ensure it understands local priorities – to influence NBN Co's technology boundary decisions where the NBN has not yet been rolled out, and where technology upgrades should be focused once rollout is completed. The Victorian Government could assist local governments (and the Regional Partnership) in identifying and prioritizing unmet needs by developing a web-based application through which users could register their need for improved fixed (and other) access service
2. Local governments consider obtaining quotes under the NBN Technology Choice program to upgrade existing or proposed NBN infrastructure where this does not meet the needs of their local business users or precincts and investigate funding models including contributions by precinct tenants
3. The Victorian Government to work with local governments and the Regional Partnership to promote competing provision of fixed broadband for businesses such as with the recent Enhanced Broadband projects taking place in Horsham and Morwell, particularly if NBN Co fails to offer effective business-grade services and reset its wholesale pricing
4. The Victorian Government to advocate to the Commonwealth Government and NBN Co to deploy technologies with the highest performance potential in the remaining rollout areas, aided by information from local governments on where demand for high performance is expected to be greatest
5. The Victorian Government advocate for a lowering of the mandatory threshold above which FTTP must be incorporated in new developments
6. The Victorian Government advocate for a restructuring of NBN wholesale pricing to ensure the maximum potential of the NBN is unlocked (including revising CVC pricing)
7. The Victorian Government make submissions to the current ACCC Domestic Transmission Capacity Services (DTCS) inquiry in relation to backhaul routes where its market insights indicate regional users are adversely impacted by high backhaul pricing
8. The Victorian Government advocate for NBN Co to expeditiously introduce high-speed, business-grade NBN services, including symmetric high bandwidth services with strong service level agreements (SLAs) to regional areas

9. Local governments to work with local businesses and community groups to better understand the incidence and impact of technology boundary issues (the 'have nots' next door to the 'haves'), and explore the feasibility of public network and bespoke solutions that address serious anomalies
10. Local governments to designate business precincts in greenfield locations that will be developed with higher grade connectivity (e.g. fibre optic, high speed wireless), to create preferred locations for businesses critically requiring reliable high bandwidth services.

Mobile access

1. Local government agencies equip their service vehicles mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds
2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs
3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations
4. The Victorian Government to work with local governments and the Regional Partnership, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to influence 5G rollout to these locations
5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas
6. Victorian Government to advocate for mobile carriers to provide standard comparable coverage data that shows probable coverage and quality (e.g. areas where streaming, browsing, voice calls, emergency calls/SMS warnings are reasonably predicated to work – disclosure of 'real' performance) to better inform future black spot funding.

IoT access

1. The Victorian Government to engage with mobile carriers and LP-WAN network operators on behalf of the Regional Partnership, local governments and business groups on their plans for IoT network deployments across the region and what information can assist to influence their rollout plans including from its agricultural IoT trials and the fieldwork conducted to support the digital plans
2. The Victorian Government include IoT support as a decision criterion in its mobile blackspot initiatives, and advocate for the Commonwealth to do the same in its future blackspot programs
3. The Victorian Government should pilot a low power (LP-WAN) IoT blackspot program and advocate for the Commonwealth to do the same
4. The Victorian Government advocate for mobile carriers to provide standard geospatial coverage maps that include the type of IoT applications that are supported.

Public WiFi access

1. Local governments to compile information on the location, footprint, target audience and use trends of their public WiFi networks, and their ambitions for wider WiFi coverage in their LGAs – to inform local government decision-makers and Victorian Government policy considerations

2. The Victorian Government to work with local governments and the Regional Partnership to identify value-adding opportunities for public WiFi in smaller regional towns and localities to meet local social needs and attract visitors and examine public WiFi co-investment models such as the state or Commonwealth government meeting the capital costs and local governments (or carriers) meeting the operating costs
3. The Victorian Government fast-track the compilation and distribution of information on its public WiFi trials currently being conducted in Shepparton, Geelong, Ballarat and Bendigo
4. The Commonwealth Government to implement programs that can be applied to support public WiFi networks, building off the experience of Victorian pilot projects.

Skills

1. The Victorian Government to allocate funding towards research that addresses the digital skills and service affordability information gaps. A start on this has been made with questions in the local government online currently being conducted at present, and in the onsite fieldwork to follow.
2. The Victorian Government to explore the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high broadband access for those in NBN fixed wireless and satellite footprints) subject to strong local support and a credible plan for ensuring their sustainability.
3. The Victorian Government should examine the case for investing in the preparation and delivery of digital education and training, focusing the training across regions as more information on skills needs are revealed from further research.

Options to address Mallee digital services affordability issues have not been considered in this initial digital plan, pending better information on the nature and importance of any affordability gaps. Data collection is the immediate need.

Primary Production Areas Analysis

Digital supply-demand balance for selected primary production areas is shown in Table 7, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

The Mallee region is characterised by vast, broadly distributed areas of agriculture and broad acre cropping that deliver substantial economic value to the region in terms of both employment (15%) and contribution to Gross Regional Product (25%).

Significant aspects of Mallee primary production revolve around fruits and nuts horticulture, dairy grazing and grains cropping.

Six major primary production areas were selected for analysis in developing the Mallee Digital Plan. Importantly, these areas do not capture the full extent of the region's primary production sector. However, they do provide indicative analysis of current digital connectivity in some of the region's key agricultural areas, enabling general conclusions to be drawn. The adequacy of digital connectivity in other areas could be assessed in future work.

Table 7 Primary production areas: current unmet digital access needs

Land Use	Location	User Type	Access		
			Fixed Supply / Demand	**Mobile*** Supply / Demand	**LP-WAN IoT** Supply / Demand
Fruits/nuts horticulture	Around Mildura	Business	L/H	H/H	H/M
		Home	M/H	H/H	H/L
	Around Robinvale	Business	L/H	M/H	M/M
		Home	M/H	M/H	M/L
	Around Swan Hill	Business	L/H	M/H	H/M
		Home	L/H	M/H	H/L
Dairy Grazing	Around Cohuna	Business	L/H	H/H	L/M
		Home	M/H	H/H	L/L
Grains Cropping	North of Birchip	Business	L/H	M/H	H/M
		Home	L/H	M/H	H/L
	West of Ouyen	Business	L/H	M/H	H/M
		Home	L/H	M/H	H/L

Legend **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

Commentary

The unmet needs picture is mixed within each of these primary production areas with fixed supply in most of them rated low-to-medium and mobile access supply rated medium to high. Low power IoT supply-demand balance is in transition – supply is predominantly reasonable (high or medium) relative to nascent demand which is expected to rise substantially over the next 3-5 years.

Fixed access

Current situation - fixed access in the primary production areas across regional Victoria comprises a mix of NBN fixed wireless and satellite technologies. For Mallee, the landmass served by satellite is relatively high – over 90%. This is particularly so for Mildura LGA (97% of landmass satellite) and Swan Hill (89%). Business and household demand is, however, uniformly high, meaning major unmet demand for fixed access across the primary production areas considered.

Looking forward 3-5 years - It is anticipated fixed access supply will change little in the next 3-5 years without policy intervention. With demand inexorably rising, this means the current level of unmet demand for fixed access will become severe. However, policies to materially alleviate this situation are likely to be prohibitively expensive.

Mobile coverage

Current situation - Mobile coverage in primary production areas of Mallee is mixed, with clear expanses of poor service. With demand for fixed services high, at least moderate shortfalls are apparent.

Looking forward 3-5 years - there is likely to be little market driven improvement on coverage and 5G technology is considered to be unlikely to replace 4G in rural and remote areas. Rising demand in the face of largely static supply will mean the unmet demand situation will worsen. Redesigned mobile blackspot programs will be needed to ameliorate this growing supply-demand gap.

Narrowband IoT

Current situation - Narrowband IoT coverage is currently reasonable relative to (low) demand across the Mallee primary production areas analysed, with the exception of dairy farming around Cohuna and to a lesser extent intensive horticulture in the Robinvale area.

Looking forward 3-5 years - demand for such coverage is expected to grow strongly, as is supply – with the supply-demand balance unclear. There may be a valid role for government market stimulation where more acute supply shortfalls become apparent.

Recommendations

The Mallee Regional Partnership high level recommendations for Primary Production Areas are similar to those identified for Significant Places and include:

1. Local governments to use this Plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and identify the most appropriate way to address them
2. Local governments and the Regional Partnership to educate those in sparsely populated locations that high-quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions
3. Local governments and regional businesses consider leveraging available government assets for cost-effective bespoke solutions
4. Victorian Government to make available to Regional Partnerships, local governments and regional stakeholders the State Level Information Management database tool to conduct more detailed analysis of unmet needs and possible solutions for places and sectors not covered by this Digital Plan
5. Advocate for the Victorian Government to explore the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high broadband access for those in NBN fixed wireless and satellite footprints) subject to strong local support and a credible plan for ensuring their sustainability.

Specific recommendations include:

Fixed access

1. Local governments engage with NBN Co to ensure it understands local priorities – to influence NBN Co's technology boundary decisions where the NBN has not yet been rolled out, and where technology upgrades should be focused once rollout is completed. The Victorian Government could assist local

governments (and the Regional Partnership) in identifying and prioritizing unmet needs by developing a web-based application through which users could register their need for improved access services.

2. The Victorian Government to advocate to the Commonwealth Government and NBN Co to deploy technologies with the highest performance potential in the remaining rollout areas, aided by information from local governments on where demand for high performance is expected to be greatest
3. The Victorian Government advocate for a restructuring of NBN wholesale pricing to ensure the maximum potential of the NBN is unlocked (including revising CVC pricing)
4. The Victorian Government make submissions to the current ACCC Domestic Transmission Capacity Services (DTCS) inquiry in relation to backhaul routes where its market insights indicate regional users are adversely impacted by high backhaul pricing
5. The Victorian Government advocate for NBN Co to expeditiously introduce high-speed, business-grade NBN services, including symmetric high bandwidth services with strong service level agreements (SLAs) to regional areas.

Mobile access

1. Local government agencies equip their service vehicles mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds
2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs
3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations
4. The Victorian Government to work with local governments and the Regional Partnership, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to influence 5G rollout to these locations
5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas
6. Victorian Government to advocate for mobile carriers to provide standard comparable coverage data that shows probable coverage and quality (e.g. areas where streaming, browsing, voice calls, emergency calls/SMS warnings are reasonably predicated to work – disclosure of 'real' performance) to better inform future black spot funding.

IoT access

1. The Victorian Government to engage with mobile carriers and LP-WAN network operators on behalf of the Regional Partnership, local governments and business groups on their plans for IoT network deployments across the region and what information can assist to influence their rollout plans including from its agricultural IoT trials and the fieldwork conducted to support the digital plans
2. The Victorian Government include IoT support as a decision criterion in its mobile blackspot initiatives, and advocate for the Commonwealth to do the same in its future blackspot programs
3. The Victorian Government should pilot a low power (LP-WAN) IoT blackspot program and advocate for the Commonwealth to do the same.

Tourist Locations Analysis

Digital supply-demand balance for selected tourist locations is shown in Table 8, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about the good coverage indicated by public coverage maps.***

Table 8 Tourist locations: current unmet needs

Type	Location	LGA	User Type	Access	
				Fixed Supply / Demand	Mobile* Supply / Demand
Permanent	Lake Tyrrell	Buloke	Operator	L/H	M/H
			Visitor	n.a	M/H
	Wooroonook Lakes Campground	Buloke	Operator	L/H	L/H
			Visitor	n.a	L/H
	Mount Wycheproof	Buloke	Operator	L/H	H/H
			Visitor	n.a	H/H
	Gateway to Gannawarra Visitor Centre	Gannawarra	Operator	L/H	H/H
			Visitor	n.a	H/H
	Kerang Lakes	Gannawarra	Operator	L/H	H/H
			Visitor	n.a	H/H
	Gunbower Island	Gannawarra	Operator	L/H	L/H
			Visitor	n.a	L/H
	Nyah Vinifera State Forest	Swan Hill	Operator	L/H	H/H
			Visitor	n.a	H/H
	Hattah Kulkyne National Park	Mildura	Operator	L/H	M/H
			Visitor	n.a	M/H
	Silo Art Trail	Yarriambiack	Operator	L/H	M/H
			Visitor	n.a	M/H
Events	Esoteric Festival	Buloke	Operator	L/H	H/H
			Visitor	n.a	H/H
	Big Cohuna Festival	Gannawarra	Operator	M/H	H/H
			Visitor	n.a	H/H
	Cullulleraine Music Festival	Mildura	Operator	L/H	H/H
			Visitor	n.a	H/H

Legend **Red** - Major supply shortfall / **Amber** - Intermediate supply shortfall / **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level. Outdoor coverage is considered to be generally sufficient for tourist locations.

Commentary

Here only fixed and mobile access technologies are relevant – fixed for site operators for WiFi backhaul and day-to-day conduct of the business and mobile for both visitors and operators. Two types of tourist locations are considered, permanent tourist attractions and periodic events such as an annual music festivals.

Present situation: Fixed access for site/event operator provision of WiFi is uniformly low relative to demand for the tourist locations analysed – primarily receiving satellite technology. Mobile coverage is mixed with poor coverage for more remote permanent attractions and reasonable for annual events (in or near towns). Looking forward 3-5 years, this pattern is expected to still prevail without intervention – it is unlikely market forces alone will sufficiently shift the supply-demand fundamentals in more remote tourist locations.

For governments, tourism-focused digital enhancement programs for permanent attractions and periodic events in more remote locations are likely to be more costly (and warrant a higher return) than events closer to settled areas.

In 3-5 years: Demand for fixed access at tourist sites is expected to rise strongly in coming years as live streaming of events becomes more prevalent and digital access and enhancements to permanent attractions becomes more important to their financial viability. Mobile coverage demand will also grow as ready mobile connectivity becomes the mandatory norm for any event or permanent attraction – including coverage on surrounding roads for map applications.

Recommendations

The Mallee Regional Partnership high level recommendations for Tourist Locations are similar to those identified for Significant Places and include:

1. Local governments to use this Plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and identify the most appropriate way to address them
2. Local governments and the Regional Partnership to educate those in sparsely populated locations that high-quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions
3. Local governments and regional businesses consider leveraging available government assets for cost-effective bespoke solutions
4. Victorian Government to make available to Regional Partnerships, local governments and regional stakeholders the State Level Information Management database tool to conduct more detailed analysis of unmet needs and possible solutions for places and sectors not covered by this Digital Plan.

Specific recommendations include:

Fixed access

1. Local governments engage with NBN Co to ensure it understands local priorities – to influence NBN Co's technology boundary decisions where the NBN has not yet been rolled out, and where technology upgrades should be focused once rollout is completed. The Victorian Government could assist local governments (and the Regional Partnership) in identifying and prioritizing unmet needs by developing a web-based application through which users could register their need for improved fixed (and other) access service.
2. The Victorian Government to advocate to the Commonwealth Government and NBN Co to deploy technologies with the highest performance potential in the remaining rollout areas, aided by information from local governments on where demand for high performance is expected to be greatest.

Mobile access

1. Local government agencies equip their service vehicles mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds
2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage

extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs

3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations
4. The Victorian Government to work with local governments and the Regional Partnership, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to influence 5G rollout to these locations
5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high-demand areas
6. The Victorian Government develop a state-wide schedule of significant visitor events, in conjunction with Regional Partnerships and local governments, where network capacity problems exist and tender for a mobile operator to provide a solution
7. Victorian Government to advocate for mobile carriers to provide standard comparable coverage data that shows probable coverage and quality (e.g. areas where streaming, browsing, voice calls, emergency calls/SMS warnings are reasonably predicated to work – disclosure of 'real' performance) to better inform future black spot funding.

Transport Corridors Analysis

Digital supply-demand balance for selected transport corridors is shown in Table 9, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about the good coverage indicated by public coverage maps.***

Here only mobile access is relevant.

Table 9 Transport corridors: current unmet needs

Road Class	ID	From	To	Comment	Mobile* Supply / Demand
A	A20	Yamba	Mildura	4G coverage by at least two carriers	H/H
	A79	Mildura	Woosang	Continuous 4G coverage by one carrier only	M/H
B	B12	Pinnaroo	Tooleybuc	Limited 4G coverage	L/H
	B220	Ouyen	Tempy	Continuous 4G coverage by one carrier only	M/H
	B220 (2)	Woomelang	Cope Cope	4G coverage by two carriers	H/H
	B260	Kerang	Macorna	4G coverage by at least two carriers	H/H
	B400	Robinvale	Gunbower	4G coverage by at least two carriers	H/H
C	All	37 roads		Patchy/low coverage	L/H
Rail		Melbourne	Bendigo	4G coverage by three carriers; good in-train reception	H/H
		Bendigo	Swan Hill	4G coverage by two carriers; uncertain in-train reception	M/H

Legend **Red** - Major supply shortfall / **Amber** - Intermediate supply shortfall / **Green** - current supply meets or exceeds demand

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

Table 9 summarises the limited analysis of mobile coverage supply and demand on major and more minor roads a rail link in Mallee conducted to demonstrate the place-and-sector approach for transport corridors and note any preliminary patterns.

Commentary

The pattern from the sample of major and minor roads is reasonable mobile coverage on major (Class A) thoroughfares and significant (Class B) roads, with poor coverage on minor (Class C) roads, again noting the limitations of the data available to provide a complete picture of service quality and continuity along roads that appear to be well served. Mobile coverage of rail routes appears to be generally good, although in-carriage reception on the Bendigo to Swan Hill link is likely to be patchy on VLocity trains.

Looking forward 3-5 years, this tentative pattern is expected to continue, with intervention required to lift mobile coverage on more minor roads.

These findings, if substantiated by further analysis, also have two-way implications: drivers will experience better mobile coverage to the extent they can stick to more significant roads, and that mobile blackspot programs aiming to achieve good coverage on more minor roads are likely to be expensive and warrant careful targeting.

Recommendations

The Mallee Regional Partnership recommendations for Tourism Corridors relate to mobile access only and are similar to those identified for Significant Places. They include:

Mobile access

1. Local government agencies equip their service vehicles mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localised solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds
2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs
3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations
4. The Victorian Government to work with local governments and the Regional Partnership, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to influence 5G rollout to these locations
5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas
6. The Victorian Government should develop a state-wide schedule of significant visitor events, in conjunction with Regional Partnerships and local governments, where network capacity problems exist and tender for a mobile operator to provide a solution
7. Victorian Government to advocate for mobile carriers to provide standard comparable coverage data that shows probable coverage and quality (e.g. areas where streaming, browsing, voice calls, emergency calls/SMS warnings are reasonably predicated to work – disclosure of 'real' performance) to better inform future black spot funding.

Glossary

ABS: Australian Bureau of Statistics

ACCC: Australian Competition and Consumer Commission

BB-IoT: Broadband Internet of Things

Cat-M1: Narrowband IoT technology

CRCP: Victorian Government $45 million Connecting Regional Communities Program

DJPR: Department of Jobs, Precincts and Regions (Victoria)

DII: RMIT-Swinburne-Telstra Digital Inclusion Index

F: Fixed internet access services – NBN fixed line, fixed wireless and satellite connections

FTTC: Fibre to the curb NBN fixed line technology – capable of providing very fast internet access

FTTN: Fibre to the node NBN fixed line technology – access speed limited by long copper loops for some customers

FTTP: Fibre to the premise NBN fixed line technology – capable of providing extremely fast internet access

GRP: Gross Regional Product (the region equivalent of Gross Domestic Product – GDP)

IoT: Internet of Things

LCCC: Local Community Connectivity Centres - facilities providing high bandwidth connectivity for the public

LGA: Local government area

M: Mobile services – third, fourth and fifth generation technology (3G, 4G, 5G)

MBSP: Mobile Black Spot Program (Commonwealth Government)

MNO: Mobile network operator

NB-IoT: Narrowband Internet of Things

NBN: National broadband network – the government-owned wholesale network covering all premises in Australia

NBN Co: The Commonwealth Government-owned business responsible for building and operating the NBN

RDAC: Regional Development Advisory Committee – the chairs of the nine Regional partnerships

SLA: Service Level Agreement

SLIM: State Level Information Management database

VMP: Victorian Mobile Program

WiFi: Wireless mobile access technology for residents and visitors in public places and some neighbourhoods

SECTION 3 – Supporting Evidence Base

1 Mallee General Characteristics

Mallee population centres, primary production areas, tourist sites & transport corridors

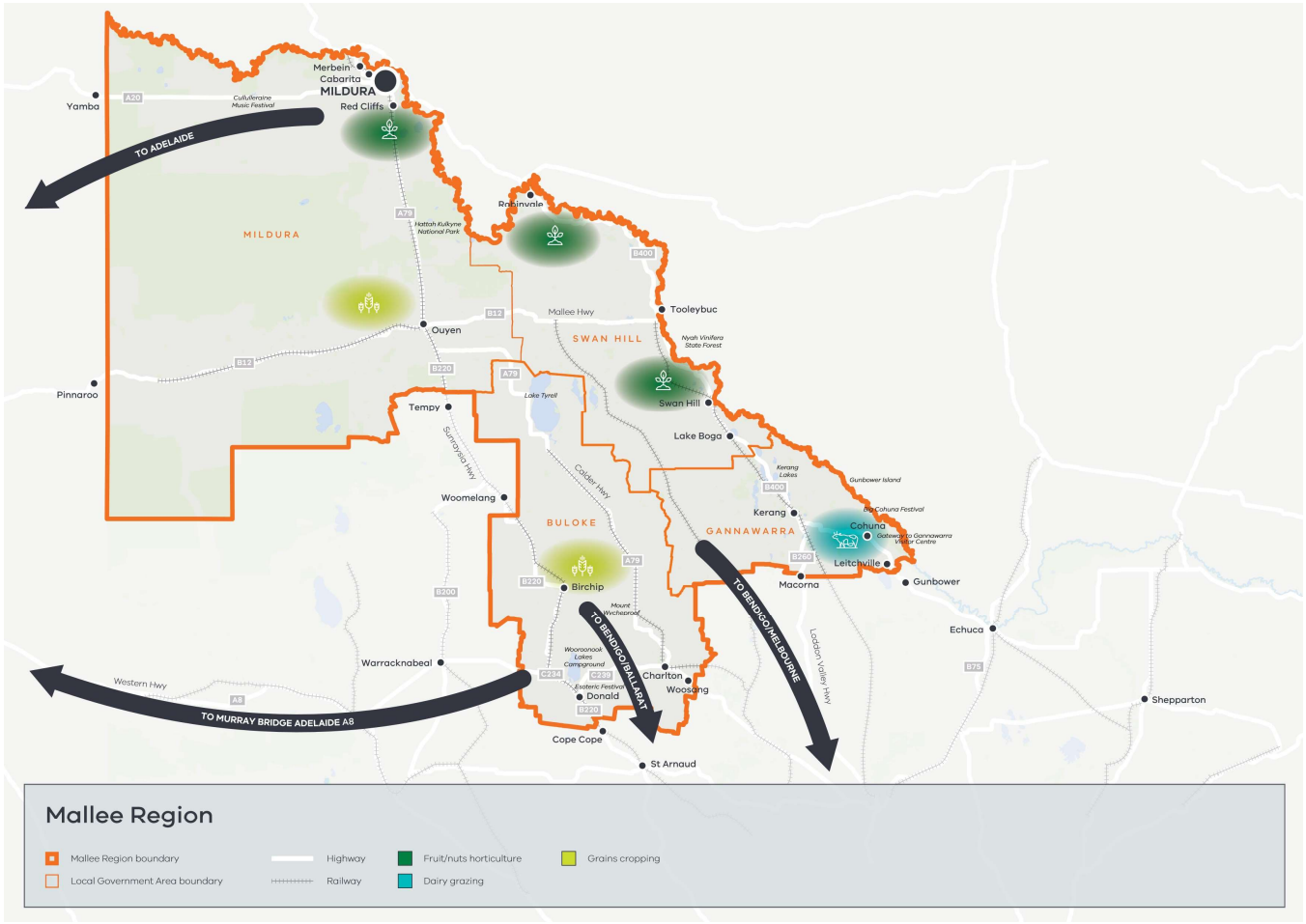

Figure 3 Mallee population centres, primary production areas, tourist sites & transport corridors

1.1 The land and the people

Population density differs widely across the region – 2.5 residents per square kilometre for Mildura LGA (strong population growth), around three for Swan Hill and Gannawarra LGAs and less than one person per square kilometre for Buloke (falling population). 36 per cent of the region's population lives in Mildura, with a further 11 per cent living in Swan Hill – almost half of the Mallee population between these cities. The rest of the population lives in towns and smaller localities across the region, on the fringe of these centres and in rural remote and locations and, reflecting their greater dispersion, experience less favourable digital connectivity than their more urbanised peers.

Farming in the region includes intensive horticulture (fruit/nuts) along the Murray, grain growing in the south, dairy around Cohuna and extensive grazing in the more remote areas. Tourist sites include year-round attractions and signature annual festivals and other periodic events. The digital connectivity needs of farms and farm households, and tourist site operators and visitors, differ across these locations depending on the nature of the primary production and tourist activities, requiring the overlay of both places and sectors in digital supply-demand analysis.

Road and rail transport corridors need good mobile coverage for continuous mobile connectivity, and repeaters on VLocity trains beyond Bendigo.

Key features are:

- Top north-west of Victoria, bounded by Murray River and South Australian Border
- Approximately 40,000 square kilometres (large)
- Population 92,000 (2016) – population density 2.3 residents per kilometres squared (low for regional Victoria)
- Four local government areas (LGAs) – Buloke (6,000), Gannawarra (11,000), Mildura (55,000) and Swan Hill (20,000)
- Main cities and towns: Mildura (33,000) and Swan hill (11,000) – typical structure of major hub and smaller nodes
- Substantial LGA diversity – size, population, density and land use – usual for regional Victoria.

1.2 The community

Whilst there are noteworthy variations across the region, the following summarises the overall profile:

- Age: 30% of population <25 years, 49% 25-64, 20% 65+ – close to the regional Victoria average
- Education: 28% of the population have post-secondary qualifications – lower than regional average (34%)
- Home internet access and employment in high technology jobs lower than regional Victoria average.

Some of the more noteworthy variations across the region are demonstrated in the following charts:

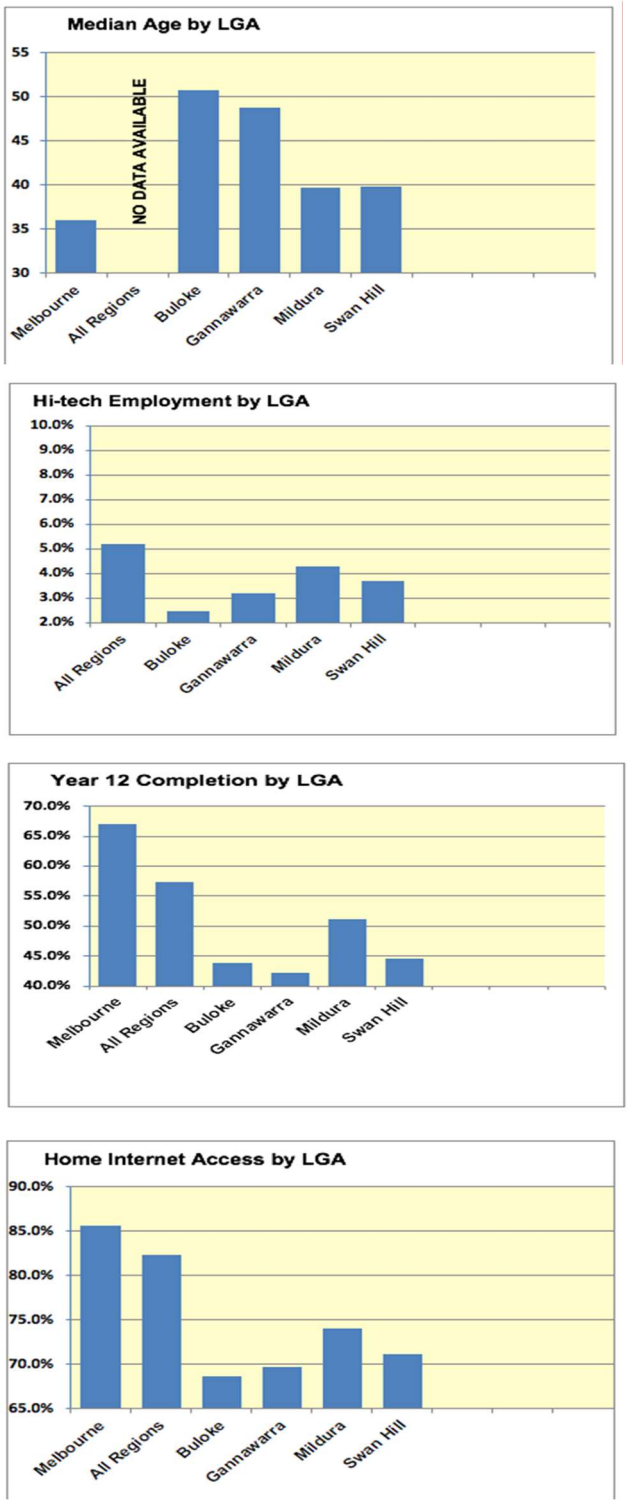

Figure 4 Comparisons of Mallee indicators of digital infrastructure demand

Notably, the residents of the Buloke and Gannawarra are on average older, have lower incomes, are less likely to access the internet from home and less likely to work in a high-technology job than those residing elsewhere in the region – more at risk of being left behind on digital development.

1.3 The economy

Gross Regional Product (GRP) $4.6 billion, with a 5% decline over the past 10 years.

Seven industry sectors make up almost two-thirds of employment in the region:

Agriculture, forestry, fishing	15%
Health care & social assistance	13%
Retail Trade	11%
Manufacturing	6%
Education & training	8%
Accommodation & food services (tourism)	5%
Construction	7%
TOTAL	65.0%

Mallee residents are employed across occupational categories as follows:

- Professional (15% of residents), technical & trades (13%), managers (18%)
- Clerical & administration (11%), Community & personal services (11%)
- Labourers (14%), sales (11%), machinery operators & drivers (7%)

International exports $0.8 billion (2017), with export-intensity (exports relative to GRP) above the regional Victoria average (17% vs 12%)

1.4 Structural change

Agriculture, health and retail are the top three industries in the region in terms of employee numbers, with only health among them showing growth over the past 10 years. This observation strongly supports the view that employment in the traditional industries is being replaced by jobs technology driven service industries. Health is in fact the fastest growing industry, with tourism and education the other notable growth industries.

However, a somewhat different picture emerges when GRP contribution is considered. From this perspective manufacturing and agriculture, two of the fastest declining industries in terms of employee numbers, are the two leading sectors, with agriculture contributing a quarter of the GRP and more than double that of manufacturing. This suggests that both warrant particular attention to their digital enablement - agriculture in particular needs to shift from its current low to high digital intensity over the next 5 years to be competitive in Australia and internationally.

1.5 Digital Intensity – now and in 3-5 years[8]

Table 10 Comparison of current and future digital intensity requirements of the main Mallee industries based on employment

Industry	Digital intensity now (current practice)	Digital intensity needed in 3-5 years (best practice)
Healthcare & social assistance	Fixed access for patient records	Patient & GP fixed and mobile connectivity. Digitisation of records, analytics & data transparency. Robot-assisted operations
Education &training	School, home fixed & mobile access	Student fixed & mobile home connectivity, online learning. Augmented & virtual reality in classrooms for enhanced teaching methods
Construction	Fixed and mobile connectivity	Fixed & mobile connectivity, digital models
Tourism	Mobile coverage of tourist hot spots	Mobile road coverage. WiFi & IoT at popular venues. Augmented/virtual reality tours
Manufacturing	Fixed connectivity	Fixed connectivity, industrial IoT, fault prevention & data analytics for logistics
Public admin & safety	Resident fixed & mobile connectivity, connected public infrastructure	Resident fixed & mobile, IoT-for Smart Cities, enhanced security & digital profiles for individuals
Agriculture/forestry	Mobile coverage of farming areas	Wide narrowband and broadband IoT access, apps and skills for intensive and broadacre horticulture, cropping & livestock
Retail trade	Shop and building access	Retail at threat from online shopping. IoT can help retail stores connect to customers through promotions and mobile payment methods

Legend: *Low* *Medium* *High*

1.6 General Characteristics Informing Digital Planning

This summary of the Mallee characteristics and structural change demonstrates the significant regional diversity and the many factors that need to be considered when developing a regional digital plan. In this Plan, a framework has been developed that attempts to address regional diversity and take into account the current and future needs of people, businesses, places and industry sectors. The framework includes place and sector-based analysis of digital supply and demand necessary for identifying specific unmet digital needs and identifying priorities. Further development of this framework is required in subsequent digital plans.

[8] McKinsey Digital – Digital Australia: Seizing the opportunity from the Fourth Industrial Revolution; OCED – A taxonomy of digital intensive sectors

2 Regional Supply Overview

2.1 Fixed Broadband

Coverage by Land Area

The map following shows NBN coverage of the Mallee region, with the LGA boundaries marked.

Areas served with FTTP, FTTC and FTTN represent less than 1% of the land area in the region and accordingly are barely visible at the scale of this map. Many of these locations are discussed in **Section 3** Significant Places.

Of note at the scale of this map is the proportion of the region that is *not* shaded with any colour – representing the areas that are serviced with the lowest performing of NBN Co's access technologies – satellite coverage.

Also visible at this scale are the areas where fixed wireless has been deployed (dark purple) or will be deployed (light purple) and some of the larger population centres where FTTP (brown) or FTTN (blue) has (or is due to be) deployed.

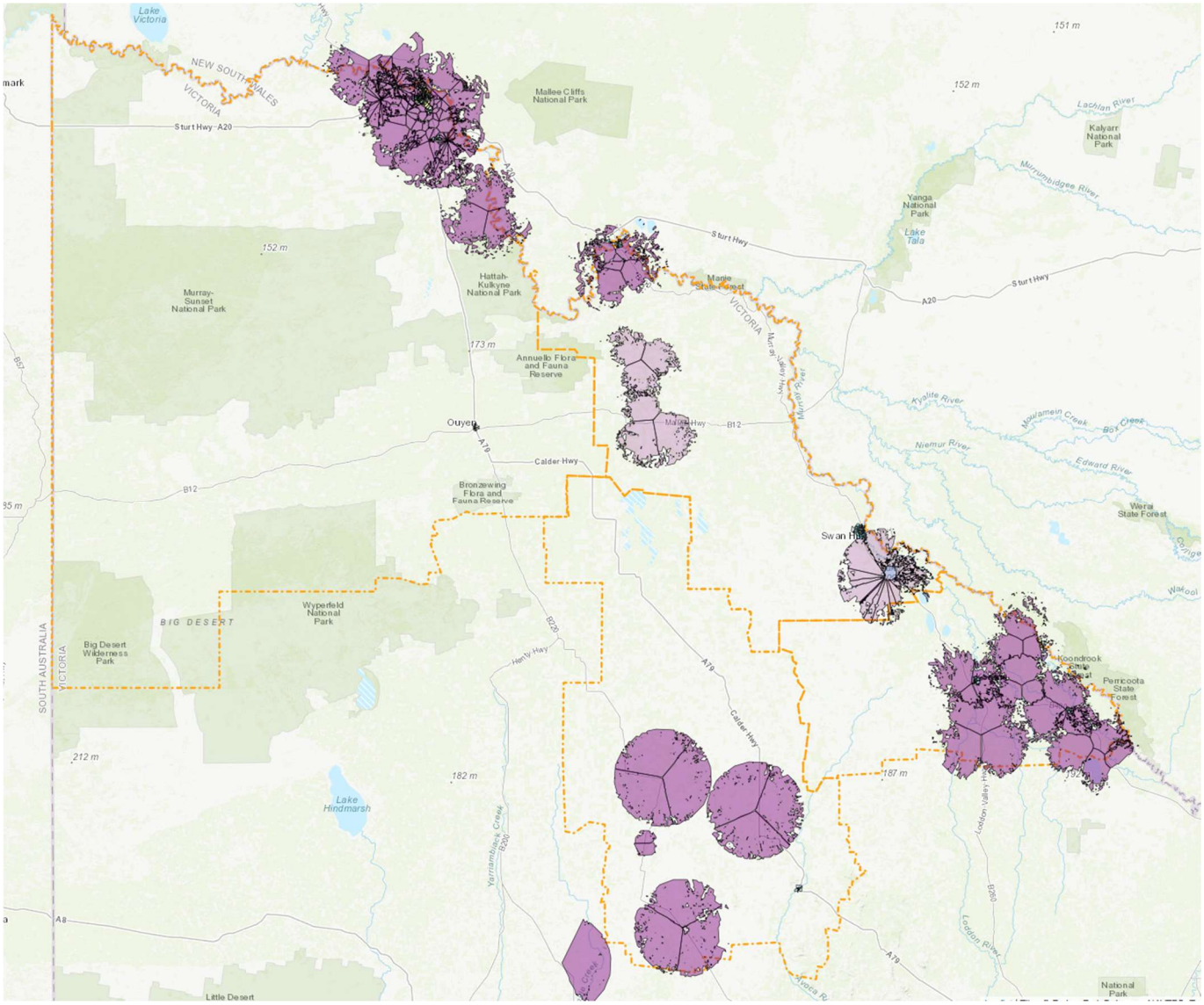

Figure 5 An Overview of NBN Technology Coverage of the Mallee Region (SLIM)

The split between fixed wireless and satellite coverage is particularly relevant in assessing how well areas of the region are served. The following table summarises NBN Co's present or planned use of these technologies for each LGA.

LGA	Area (km²)	NBN Technology (% Area)	
		FW	SAT
Buloke	8,006	17%	83%
Gannawarra	3,744	19%	81%
Mildura	22,132	3%	97%
Swan Hill	6,123	11%	89%
Region (km²)	40,005	3,313	36,630

Coverage of Businesses

Across the Mallee region, there are 3,844 businesses registered with Workcover. The NBN technology that either currently serves (or is destined to serve) these businesses is as shown in the chart below.

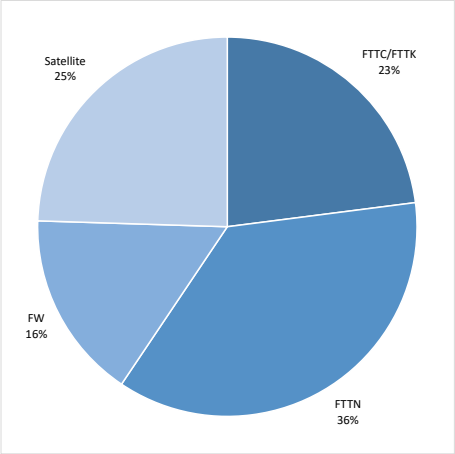

Figure 6 Businesses served by different NBN technologies

Differences across the LGAs that make up the region are quite significant, as summarised in the table below.

LGA	No. Bus.	Approximate Coverage (%)				
		FTTP	FTTB FTTC	FTTN	FW	SAT
Buloke	320	0%	0%	14%	49%	37%
Gannawarra	465	0%	2%	43%	28%	28%
Mildura	2,067	0%	42%	27%	13%	18%
Swan Hill	992	0%	0%	61%	6%	34%
Region (no.)	3,844	0	883	1,401	618	942

Coverage of Dwellings

NBN Co's use of different technologies to service particular residential areas can be examined visually within SLIM by zooming to a detailed (town or street level) view.

At an overview level, the following table summarises coverage by technology type for GNAF[9] addresses *(see important qualification in footnote)* that lie within residential-zoned areas.

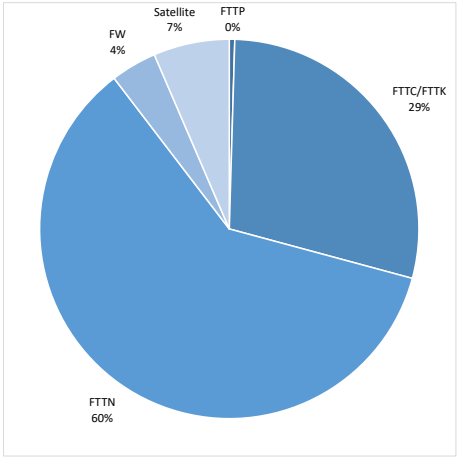

Figure 7 GNAF addresses served by different NBN technologies

LGA	No. Res.	Approximate Coverage (%)				
		FTTP	FTTB FTTC	FTTN	FW	SAT
Buloke	0	0%	0%	0%	0%	100%

[9] The GNAF database contains addresses in land that is zoned commercial, industrial and residential. As such, it excludes properties located (for example) within land zoned for farming.

Gannawarra	3,762	0%	5%	72%	11%	11%
Mildura	21,587	0%	43%	51%	2%	4%
Swan Hill	7,469	1%	0%	82%	7%	11%
Region (no.)	32,818	152	9,431	19,825	1,288	2,122

Whilst NBN Co's satellite solution is intended to service the most remote 3% of the population, a very much higher proportion will be reliant on it in the Buloke, Gannawara and Swan Hill LGAs. The overall percentage (6%) is also higher than the national average and would be significantly higher if the additional dwellings in farming areas were to be included.

2.2 Mobile Coverage

Public Coverage Maps

Access to mobile coverage data is currently under discussion between the Department and the mobile network operators.

In the interim, only very high-level perspectives can be obtained from the public coverage maps provided by each of the three established mobile network operators.

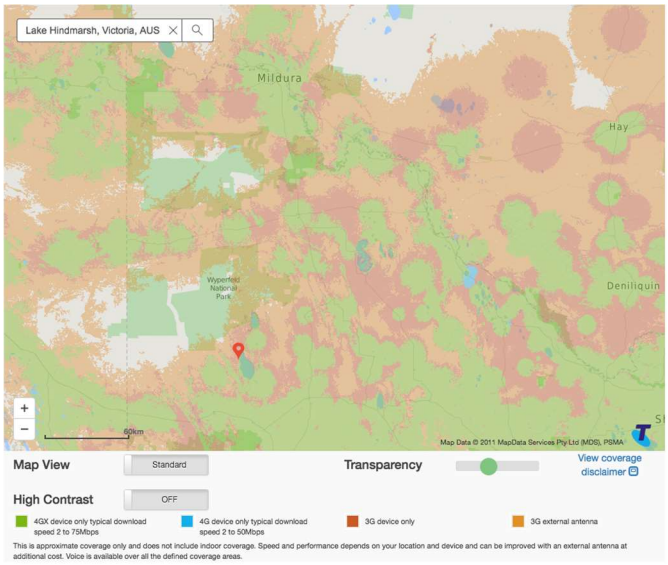

Figure 8 Telstra mobile Public Coverage Map of Mallee Region

Telstra's public coverage map indicates good coverage with:

- 4GX (typically download speed 2 to 75 Mbps) in green
- 3G in dark brown
- 3G with external antenna in light brown.

By simple visual examination of this map, Telstra appears to support coverage over at least 80% of the region.

The Optus public coverage map (see opposite) is based on using a nominated device outdoors. For the purposes of this report, a handheld iPhone 6 has been assumed. In interpreting the map:

- purple indicates 4G Plus coverage
- blue indicates 3G coverage
- yellow indicates 3G coverage with an external antenna.

By simple visual examination of this map, Optus appears to offer coverage at least equivalent to Telstra.

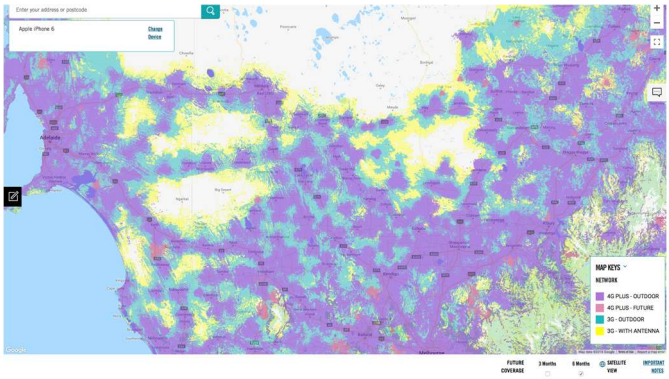

Figure 9 Optus mobile Public Coverage Map of Mallee Region

The most noteworthy gap evident in both Telstra and Optus coverage is in the area of dessert national parks. Significant coverage gaps are scattered across the region, with increased reliance on external antenna coverage for service in many areas.

As for Optus, Vodafone's public coverage maps are based on using a nominated device, and for comparison with the Optus map, an iPhone 6 has been assumed.

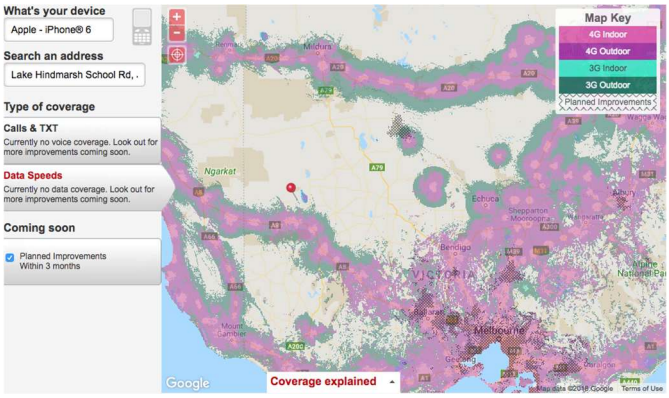

Figure 10 Vodafone mobile Public Coverage Map of Mallee Region

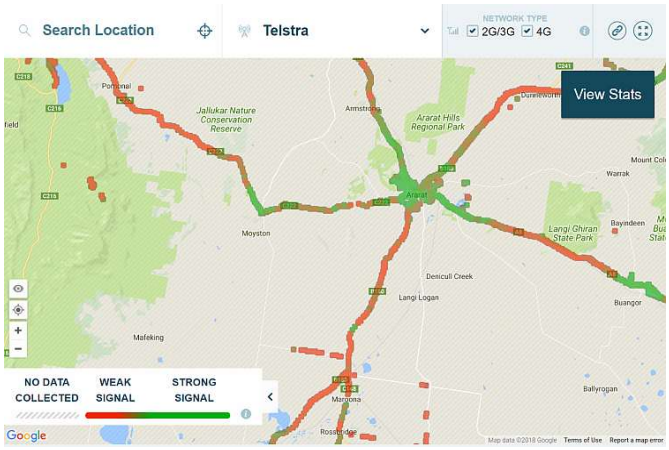

Figure 11 OpenSignal Mapping of Coverage around Ararat

In interpreting the map:

- light purple indicates 4G indoor coverage
- dark purple indicates 4G outdoor coverage
- light green indicates indoor 3G coverage
- dark green indicates outdoor 3G coverage
- shaded areas indicate where coverage enhancements are due to take place in the near future.

Based on the maps, Vodafone's coverage includes good coverage of several major roads traversing the region and localised coverage at several population centres, but otherwise no coverage at all.

Crowd-sourced Coverage Information

In practice, the public coverage maps provided by the carriers do not always accord with end-user experience. A range of applications have been developed to capture users' real-world experiences and integrate these into databases.

An example is the OpenSignal[10] application and database, and a sample of the maps produced from these sources (in this case, in the area of Ararat in the Central Highlands region) is provided below. These applications can provide useful insights into (especially) transport mobile blackspots – but are less useful in assessing wide area coverage because of the difficulties of testing everywhere.

The use of these applications by stakeholders (such as local Government staff) may be valuable in building evidence of transport mobile blackspots.

General Notes

Coverage is constantly evolving as a result of ongoing MNO investment in new base stations - including new base stations supported by the Commonwealth Mobile Blackspot Programs (MBSP) and the Victorian Governments Blackspot Programs (VMP3).

In addition, the mobile networks are evolving through successive technology generations.

In particular, fifth generation (5G) mobile technology is expected to commence general deployment in 2020, bringing with it significantly increased capacity, the ability to support a vastly increased number of devices and new features of particular relevance to "Internet of Things" (IoT) applications. These capabilities are discussed more fully in the overarching report.

Mobile coverage is discussed in the analysis that is provided in **Section 3** Significant Places for cities, towns and smaller localities in the region. *In all cases*, the outlook 5 years hence depends significantly on the pace and extent to which 5G technology is rolled out in regional areas of Victoria.

The mobile network operators are progressively introducing support for the Cat-M1 and NB-IoT protocols – suited to various IoT purposes. To date, only Optus has provided information for inclusion in SLIM. The Optus coverage relates to agricultural IoT trials being conducted in the north of the state and in

[10] See https://opensignal.com/networks, accessed on 10 July 2018.

Gippsland. Coverage that extends to any areas of this region is noted.

Mobile Coverage Challenges

The market dynamics of the fixed and mobile markets vary considerably in Australia.

In the fixed broadband market, the Australian Government responded with the NBN initiative to a growing divide between urban and rural areas. In urban areas, high population densities and concentrated consumer spending attracted network investment and competition. In addition, Telstra was required to grant other carriers access to its copper network to moderate what would otherwise have been a near-monopoly grip on the market.

There has been no similar intervention in Australia's mobile network - though the challenges are broadly parallel. In particular, investment has flourished in urban areas, but languished in rural areas where there is insufficient revenue-generating traffic to drive commercial returns. As a result, only around one third of Australia's landmass enjoys mobile coverage. The percentage in Victoria is significantly higher – estimated at around 75% - as a consequence of comparatively high population densities.

It is not realistic to expect 100% coverage of Australia's vast land-mass. However, with the advent of smart phones and data capabilities, the mobile networks are becoming ever more important all Australians for many different purposes including (but not limited to):

- social amenity
- occupational health and safety (noting that in emergency situations, triple-zero calls can be made on *any* available network)
- on-the-spot access to information and services relevant to one's business, lifestyle and/or well-being
- supporting IoT applications
- as a supplement (or alternative) to a fixed broadband service, especially in areas served only by NBN Co's satellite service.

At the present level of coverage (by any MNO) many of the potential socio-economic benefits remain "out of reach". In this context, pushing the boundaries of mobile network coverage promises social-economic benefits that can be disproportionate to the additional revenue opportunities available to carriers.

The challenges for the MNOs are understandable. If investment in extending coverage to an area does not generate sufficient additional revenue generating traffic to be profitable, it is not a prudent use of shareholder funds.

The structure of the mobile market in Australia leads to the question of what constitutes a mobile blackspot. Most Australians subscribe to one and only one mobile network – and for many such Australians, a blackspot exists if the particular operator that they have chosen does not offer coverage relevant to their location and transport patterns.

However, one of the benefits of the vigorous competition that prevails to attract mobile users in urban areas is a rich array of competitively priced options. As a result, for those users whose preferred MNO does not provide coverage in all the areas that they frequent, the cost of subscribing to a secondary plan is typically not prohibitive. There are also "dual SIM" phones that facilitate management of connectivity in a two-network environment.

2.3 LP-WAN Coverage

General Notes

LP-WAN technologies are designed for low-bandwidth transmission of small packets of information, with the radio technology supporting battery life of several years, making it well-suited for remote IoT sensors. Two-way protocols can be used for both monitoring (for example, meters, alarms etc) and control responses. In contrast, one-way protocols support only monitoring, but typically achieve longer battery life by obviating the need to "listen" for transmissions.

The original providers of LP-WAN technology coverage are:

- NNNCo, with LoRaWAN technology; LoRa is a two-way protocol; at this stage, no information about coverage is available
- Thinxtra, with Sigfox technology – Sigfox is also a two-way protocol
- Taggle, a one-way technology used widely for water meter reading.

Deployment of these LP-WAN technologies (LoRa, Sigfox and Taggle) is driven by project-specific opportunities, rather than by up-front investment in coverage in the hope that applications will follow.

The major mobile network operators are rapidly moving into the provision of LP-WAN services (NB-IoT), with data available for digital plan analysis on Optus NB-IoT coverage.

In addition to utilising LP-WAN technologies, Smart City and Smart Town initiatives can often take advantage of short-range technologies such as WiFi, coupled with backhaul provided by an NBN service, an independently sourced connectivity solution or a mobile network service.

LoRa

An Australian company, NNNCo Pty. Ltd., is a leading proponent LoRa technology and is known to be working in a range of smart city and rural applications. Details of coverage established in support of these projects are not published. In addition to NNNCo, various other parties are known to have deployed LoRa base stations for trial purposes and/or for particular applications.

Sigfox

Sigfox publishes a global coverage map[11]. The diagram below shows coverage in the Mallee Region in blue. In contrast to the Taggle map (see following), the Sigfox map appears to take account of topographic occlusions – as evidenced by the irregular patterns of coverage at the fringes of coverage areas.

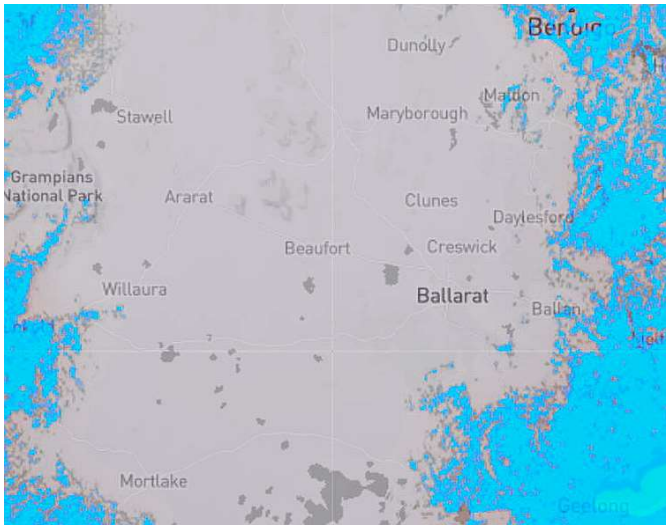

Figure 12 Sigfox Coverage of Mallee Region

Based on this map, there may be some coverage around the fringes of the Mallee Region.

Taggle

Taggle has provided indicative coverage maps for inclusion in the SLIM GIS, but they do not reflect any topographic occlusions that may affect communications at the margins. Nominal coverage is as shown in orange in the diagram that follows – field testing to confirm communications towards the fringes of coverage areas would be prudent as additional base stations may need to be deployed to assure good connectivity.

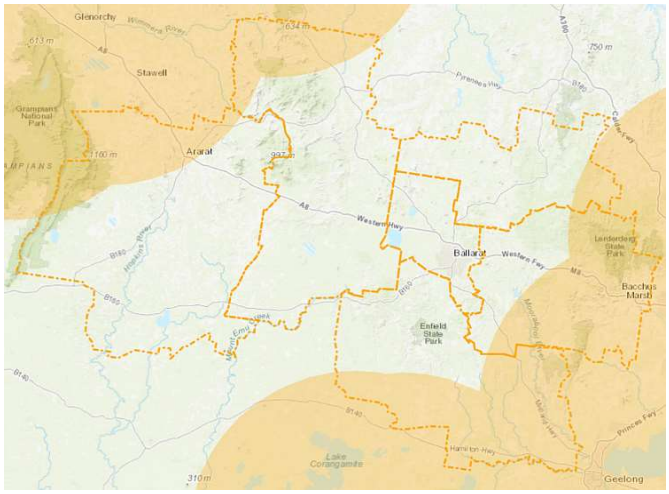

Figure 13 Taggle Coverage of the Mallee Region (SLIM)

[11] Map derived from Sigfox coverage map published at http://www.sigfox.com/en/coverage (accessed on 3 July 2018).

2.4 Other Connectivity Options

The analysis of places notes where VicTrack fibre passes through (or nearby) a population centre. Access to the fibre may be possible subject to commercial arrangements, and the availability of suitable access points.

Also, in the context of "other" connectivity options, the power transmission network commonly includes optical fibre in the Overhead Power Ground Wires (OPGWs) that protect the power lines below from lightning strikes. Whilst it is not known if fibre capacity is available and accessible on any particular segment of the power transmission network, the proximity of a location to the power transmission network is noted where applicable.

In various locations, commercial providers such as Telstra, Optus, Nextgen and OTHERS may be able to offer connectivity solutions for a wide range of purposes. Details of their infrastructure are currently not available in SLIM.

2.5 SLIM Analysis

Whilst various of the broad perspectives offered in this report are based on information from the SLIM GIS, SLIM is at its most powerful for detailed analysis of particular areas. Stakeholders are encouraged to build familiarity with the system when it is publicly available in order to be able to investigate particular needs in their jurisdictions, combining the information in SLIM with local knowledge.

3 Significant Places

The 14 places selected for analysis in this section include all cities (population[12] > 10,000), all towns (population > 1,000) and the larger locality (population <1000) in each LGA that makes up the region.

In combination, the 14 places accommodate 68.8% of the region's population of 92,634. The proportion included in the analysis would be higher if those living in the immediate surrounds of each named place were to be counted.

The balance of the region's population (31.2%) is living in communities with a population of less than 250, or on isolated properties (farms and the like). Based on an average Victorian household size of 2.6 as reported by the ABS[13], this equates to an estimated 11,000 households outside of the places considered in the following subsections.

The source of data in this section is cited for the first (only) reference of its type.

3.1 City of Mildura-Buronga

Mildura is a regional city in North-West Victoria, sitting on the banks of the Murray River. It is the largest settlement in the Sunraysia region, located in the Shire of Mildura local government area. Mildura is a major horticultural centre notable for its grape production, supplying 80% of Victoria's grapes. Other key crops produced in the district include citrus, almonds and dried fruit.

General characteristics of the city that provide an indication of the city's likely telecommunications demand profile include:

- The population of Mildura-Buronga grew by 11.4% over a decade to 33,444 in 2016, above the median growth rate of -1.5% for the 14 major places analysed in the region
- 14,627 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.5% being in full-time employment and 30.9% in part-time employment (with the remainder not at work at the time of the June 2016 census)
- 11.3% of the labour force classified themselves as managers, 17.9% as professionals and 11.5% as clerical and administrative workers
- 3.7% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 5.4% cited combined primary and secondary education
- One public hospital and one private hospital are located in the city
- The city has five primary schools, three primary/secondary schools, a TAFE and a university
- With a median age of 39, Mildura-Buronga has one of the younger populations in regional Victoria and just above the Victorian median of 37
- The ABS report a median annual household income of $53.3K for Mildura-Buronga, above the median of $45.7K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 1,263 businesses in the city or its near surrounds
- In 73.7% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 18.5% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 16.8% have completed level III or IV trade certificates
- another 12.6% have completed year 12.

[12] All population figures cited in this report are based on the 2016 Census, published by the Australian Bureau of Statistics.

[13] Much of the data for locations and larger areas is sourced from the ABS Quickstats site (see http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/2?opendocument).

ABS Industry employment data from 2016 indicated that the Mildura LGA had 4.3% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Mildura-Buronga as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

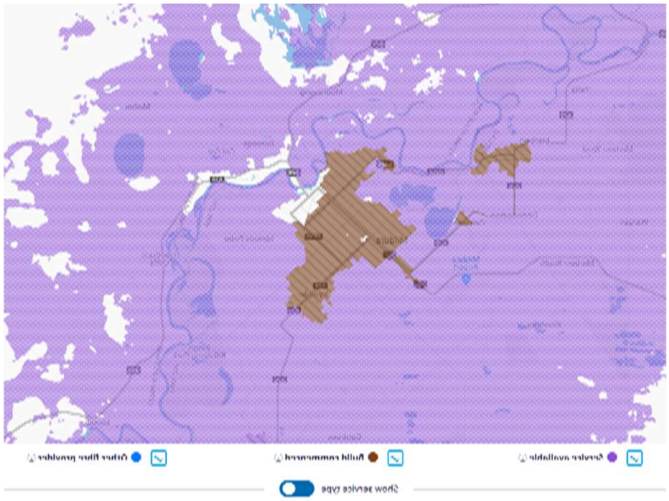

Figure 14 NBN Coverage of Mildura-Buronga (NBN Co)

The NBN coverage map above shows a large proportion of Mildura city's NBN fixed line services currently under construction (brown areas). Our analysis reveals that Mildura city will predominantly be served by a mix of NBN FTTN and FTTC, with these technologies spread throughout the city. This means many properties receiving FTTN services may be located immediately adjacent to premises receiving FTTC technology. Outside of the NBN fixed line footprint NBN fixed wireless services are available.

The map shows an area to the north-east of the city that is only able to access NBN satellite services. Satellite imagery of this area shows a significant aggregation of premises, which will face a significant disparity in the quality of NBN services they can access compared to those in nearby NBN fixed line areas once construction is complete.

Examining business location data, there appear to be a range of businesses sparsely spread throughout the surrounding areas to the city that receive NBN fixed wireless services.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire city
- Optus shows 4G Plus outdoor coverage across the entire city
- Vodafone shows 4G indoor coverage across the entire city.

In summary, there appear to be no mobile coverage issues in the city, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is Sigfox coverage in the city.

Taggle does not have coverage in the city.

Public WiFi Coverage

There is free WiFi coverage at Mildura Arts Centre and Telstra Air hotspots located in the town. Additionally, free WiFi access is available at the Mildura Library during library hours.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.2 City of Swan Hill

Swan Hill is a city in the north-west of Victoria on the Murray Valley Highway and on the south bank of the Murray River, downstream from the junction of the Loddon River and 338 kilometres north-west of Melbourne.

General characteristics of the city that provide an indication of the city's likely telecommunications demand profile include:

- The population of Swan Hill grew by 9.5% over a decade to 10,600 in 2016 above the median growth rate of -1.5% for the 14 major places analysed in the region
- 4,724 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 57.7% being in full-time employment and 31.4% in part-time employment
- 13.7% of the labour force classified themselves as managers, 17.0% as professionals and 12.0% as clerical and administrative workers
- 5.5% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 3.3% cited secondary education and 3.1% cited primary education
- One public hospital is located in the city
- The city has four primary schools, two secondary schools, three primary/secondary schools and a TAFE
- With a median age of 39, Swan Hill has one of the younger populations in regional Victoria and just above the Victorian median of 37
- The ABS report a median annual household income of $56.8K for Swan Hill, above the median of $45.7K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 529 businesses in the city or its near surrounds
- In 72.1% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 17.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.2% have completed level III or IV trade certificates
- another 12.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Swan Hill LGA had 3.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Swan Hill as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

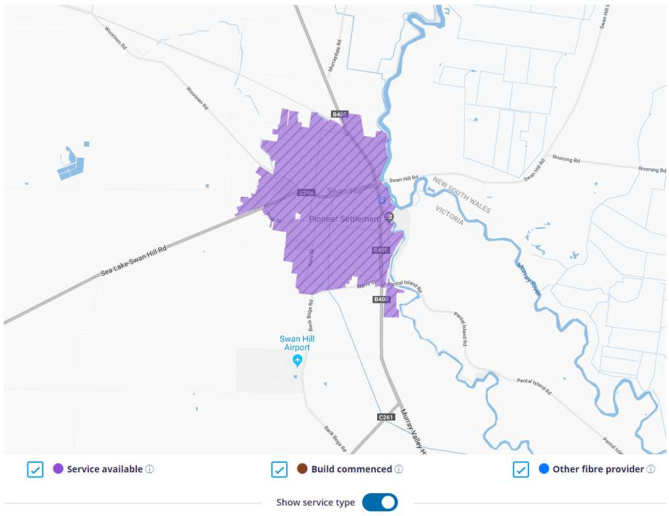

Figure 15 NBN Coverage of Swan Hill (NBN Co)

The NBN Coverage Map shows that Swan Hill has access to NBN fixed line services, with the surrounding areas served by NBN satellite only. Our analysis reveals that Swan Hill town centre is almost exclusively provisioned with NBN FTTN, with a couple of small pockets of NBN FTTP, most likely in new developments.

Examining satellite imagery of the area reveals the surrounding areas to be sparsely populated, however there appears to be a small aggregation of properties to the north-west of the town outside of the NBN fixed line footprint. There will be a large disparity in service quality available to premises outside of the NBN fixed line footprint compared to those within it.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire city
- Optus shows 4G Plus outdoor coverage across the entire city
- Vodafone shows 4G indoor coverage across the entire city.

In summary, there appear to be no mobile coverage issues in the city, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is Taggle coverage in the city.

There is no Sigfox coverage in the city.

There is partial Optus IoT coverage in the city

Public WiFi Coverage

There are no known public WiFi zones in the town but, free WiFi access is available at the library during library hours.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.3 Town of Kerang

Kerang is a rural town on the Loddon River in northern Victoria. It is the commercial centre to an irrigation district based on livestock, horticulture, lucerne and grain. It is located 279 kilometres north-west of Melbourne on the Murray Valley Highway a few kilometres north of its intersection with the Loddon Valley Highway.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Kerang declined by 3.9% over a decade to 2016, below the median growth rate of -1.5% for the 14 major places analysed in the region
- 1,474 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 52.8% being in full-time employment and 35.2% in part-time employment
- 14.1% of the labour force classified themselves as managers, 14.5% as professionals and 11.1% as clerical and administrative workers
- 6.1% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 5.3% cited local government administration and 3.6% cited aged care residential
- One public hospital is located in the town
- The town has three primary schools and a primary/secondary school
- With a median age of 49, Kerang is older than the median of 47 for the major places analysed in the region and well above the Victorian median of 37
- The ABS report a median annual household income of $46.1K for Kerang, just above the median of $45.7K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 173 businesses in the town or its near surrounds
- In 68.6% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 14.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.5% have completed level III or IV trade certificates
- another 9.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Gannawarra LGA had 3.2% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Kerang as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed Line services are planned or under construction.

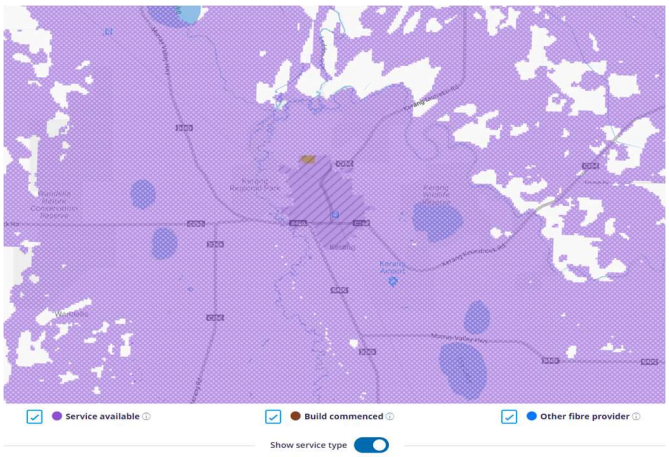

Figure 16 NBN Coverage of Kerang (NBN Co)

The NBN Coverage Map above shows that the Kerang town centre is served by NBN fixed line technology. Our analysis reveals that the NBN fixed line footprint is comprised of NBN FTTN. Outside of the NBN fixed line footprint, premises are served by NBN fixed wireless with consistent coverage in all directions.

Examining satellite imagery of the area reveals a number of premises and businesses close by to the south of the town outside of the NBN fixed line footprint which are served by fixed wireless services.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows 3G and 4G indoor coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is Sigfox coverage in the town.

There is Optus IoT coverage in the town.

Taggle does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town but, free WiFi access is available at the library during library hours.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.4 Town of Red Cliffs

Red Cliffs is a town in northern Victoria, in the Sunraysia region. It is located on the Calder Highway, 16 kilometres south of Mildura and 544 kilometres north-west of Melbourne. The main industry is the growing of citrus fruits and grapes. Red Cliffs takes its name from the 70 metre cliffs 4.5 kilometres east of the town that have an apparent red/orange colour.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Red Cliffs grew by 6.7% over a decade to 2,919 in 2016 above the median growth rate of -1.5% for the 14 major places analysed in the region
- 1,074 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 52.7% being in full-time employment and 32.2% in part-time employment
- 9.9% of the labour force classified themselves as managers, 12.1% as professionals and 8.9% as clerical and administrative workers
- 3.8% of the labour force cited their industry of employment as aged care residential and 3.0% cited secondary education
- The nearest hospital is located in Mildura to the north
- The town has three primary schools
- With a median age of 42, younger than the median of 47 for the major places analysed in the region but above the Victorian median of 37
- The ABS report a median annual household income of $44.9K for Red Cliffs, just below the median of $45.7K for the places analysed in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 84 businesses in the town or its near surrounds
- In 67.8% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 12.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.9% have completed level III or IV trade certificates
- another 9.5% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mildura LGA had 4.3% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Red Cliffs as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

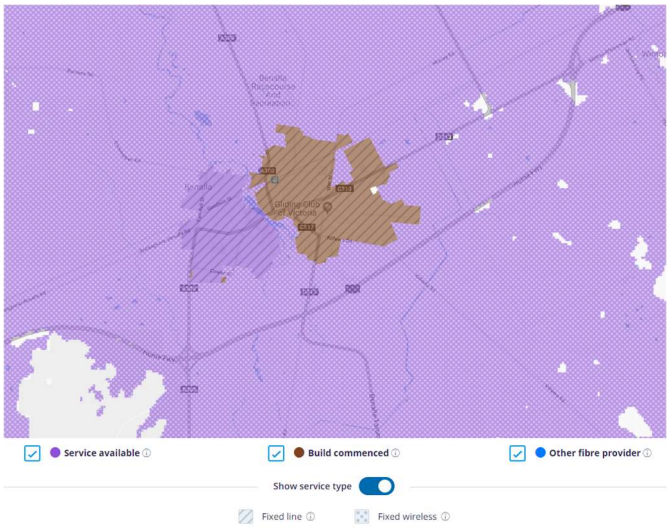

Figure 17 NBN Coverage of Red Cliffs (NBN Co)

The NBN Coverage map above shows the town centre is served by NBN fixed line services, which our analysis reveals to be exclusively FTTN services. There is good consistent coverage of NBN fixed wireless services outside of the NBN fixed line footprint. There are businesses located in the surrounding NBN fixed wireless area but there do not appear to be any high concentrations in specific areas.

Examining satellite imagery of the area reveals some groupings of premises to the north and south of the NBN fixed line footprint which are only able to access NBN fixed wireless services.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows 4G indoor and outdoor coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is Sigfox coverage in the town.

Taggle does not have coverage in the town.

Optus IoT does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town but, free WiFi access is available at the library during library hours.

Other

The town is neither on the VicTrack or the power transmission fibre routes.

3.5 Town of Robinvale

Robinvale is a town on the south bank of the Murray River in north western Victoria. It is connected by a bridge to Euston on the other side of the river in New South Wales. Robinvale is known for production of grapes, olives, carrots and almonds. Robinvale is a popular camping area on the Murray.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Robinvale declined by 2.7% over a decade to 2,154 in 2016 below the median growth rate of -1.5% for the 14 major places analysed in the region
- 753 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 58.4% being in full-time employment and 22.7% in part-time employment
- 12.8% of the labour force classified themselves as managers, 12.2% as professionals and 7.9% as clerical and administrative workers
- 6.8% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.4% cited secondary education

- One public hospital is located in the town
- The town has two primary/secondary schools and a TAFE
- With a median age of 35, Robinvale has one of the youngest populations in regional Victoria
- The ABS report a median annual household income of $50.5K for Robinvale, above the median of $45.7K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 96 businesses in the town or its near surrounds
- In 55.7% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 11.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 9.0% have completed level III or IV trade certificates
- another 18.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Swan Hill LGA had 3.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Robinvale as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

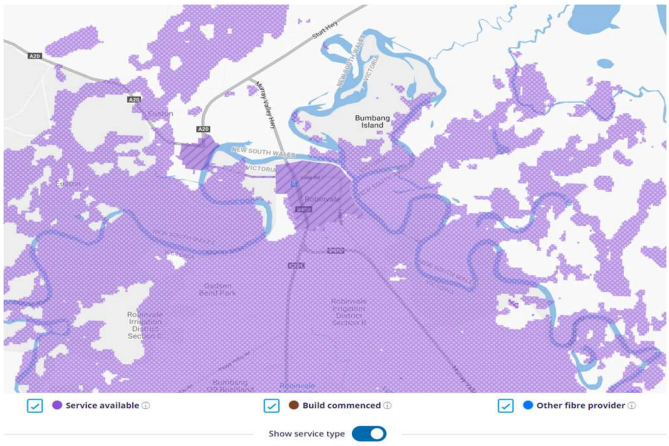

Figure 18 NBN Coverage of Robinvale (NBN Co)

The NBN Coverage Map above shows Robinvale town centre is able to access NBN fixed line services, which our analysis reveals to be FTTN. The surrounding areas are able to access NBN fixed wireless services, except for a region to the west of the town which is only served by NBN satellite. However, satellite imagery does not reveal many premises located in this NBN satellite area.

While there are a number of businesses located to the south of the town served by NBN fixed wireless, these businesses are sparsely located over large distances.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows 4G indoor and outdoor coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is partial Taggle coverage in the town.

Sigfox does not have coverage in the town.

Optus IoT does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.6 Town of Merbein

Merbein is a town just north of Mildura in the Sunraysia region. It is on the Calder Highway 12 kilometres from Mildura and 553 kilometres from Melbourne. The town is known for farming and is part what is informally called the "fruit bowl" or "food bowl", the growing region roughly made of the Coomealla and Sunraysia irrigation districts fed by the Darling and Murray rivers. Visitors come to Merbein for its great views of the Murray River from the cliffs near the Mildura winery, boat ramps and allocated camping areas along the river.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Merbein grew by 0.4% over a decade to 1,981 in 2016 above the median growth rate of -1.5% for the 14 major places analysed in the region
- 773 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 51.6% being in full-time employment and 31.4% in part-time employment
- 9.9% of the labour force classified themselves as managers, 9.9% as professionals and 10.9% as clerical and administrative workers
- 4.8% of the labour force cited their industry of employment as aged care residential
- The nearest hospital is located nearby in Mildura to the south
- The town has a primary/secondary school
- With a median age of 47, Merbein has the median age of the places analysed in the region and is older than the Victorian median of 37
- The ABS report a median annual household income of $40.5K for Merbein, below the median of $45.7K for the places analysed in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 56 businesses in the town or its near surrounds
- In 65.3% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 9.8% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.0% have completed level III or IV trade certificates
- another 9.8% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mildura LGA had 4.3% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Merbein as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

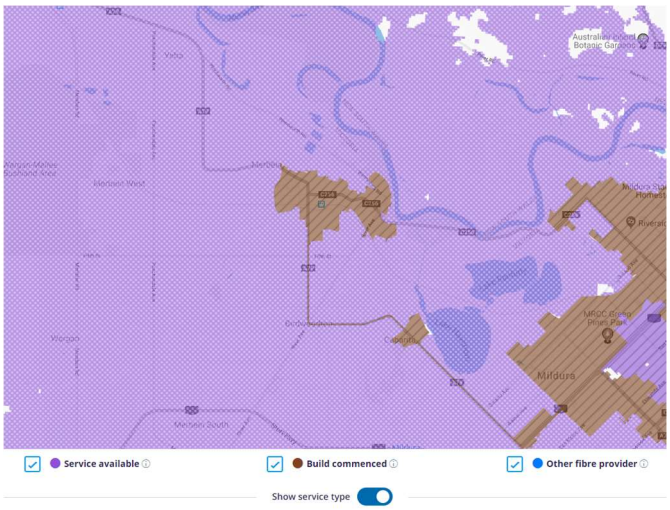

Figure 19 NBN Coverage of Merbein (NBN Co)

The NBN Coverage Map above shows that the town of Merbein is under construction for NBN fixed line services (brown area). Our analysis reveals that Merbein will receive a mix of FTTN and FTTC

technologies in this rollout. There is good coverage of NBN fixed wireless services in the surrounding areas outside the NBN fixed line footprint.

Examining satellite imagery of the area does not reveal significant aggregations of premises outside of the NBN fixed line footprint under construction.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows 4G outdoor coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is Sigfox coverage in the town.

Taggle does not have coverage in the town.

Optus IoT does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town but, free WiFi access is available at the library during library hours.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.7 Town of Cohuna

Cohuna is a town situated 274 kilometres north of Melbourne, on the Murray Valley Highway, in northern Victoria. Surrounded by dairy farms, and situated on the banks of Gunbower Creek, the town is a popular holiday spot as well as a regional sports centre with a wide range of facilities.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Cohuna declined by 1.4% over a decade to 1,866 in 2016 which is close to the median growth rate for the 14 major places analysed in the region
- 678 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 51.3% being in full-time employment and 37.6% in part-time employment
- 13.9% of the labour force classified themselves as managers, 12.5% as professionals and 12.0% as clerical and administrative workers
- 5.2% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 4.1% cited primary education
- One public hospital is located in the town
- The town has two primary schools
- With a median age of 56, Cohuna is older than the median of 47 for the major places analysed in the region and well above the Victorian median of 37
- The ABS report a median annual household income of $43.0K for Cohuna, below the median of $45.7K for the places analysed in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 110 businesses in the town or its near surrounds
- In 64.1% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 13.1% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 16.6% have completed level III or IV trade certificates
- another 9.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Gannawarra LGA had 3.2% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Cohuna as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple /

spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

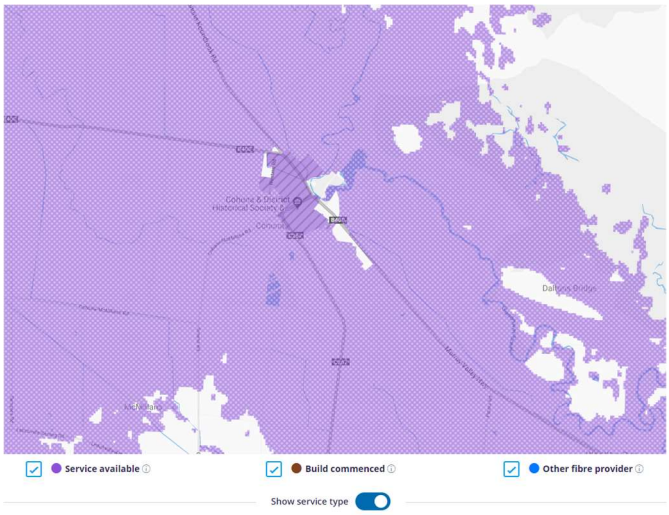

Figure 20 NBN Coverage of Cohuna (NBN Co)

The NBN Coverage Map above shows the town centre of Cohuna has access to NBN fixed line services. Our analysis reveals these services are FTTN. The coverage map above shows a small area to the west and some larger areas to the east of the town which are only able to access NBN satellite services. Examining satellite imagery of these areas reveals a number of premises, particularly in the areas to the east. This will lead to significant disparities in the quality of services accessed by premises in these zones compared to premises located nearby in the NBN fixed line footprint.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows 4G outdoor coverage across small parts of the town.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators.

LP-WAN Coverage

There is partial Optus IoT coverage in the town.

Taggle does not have coverage in the town.

Sigfox does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town but, free WiFi access is available at the library during library hours.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.8 Town of Donald

Donald is a town in Victoria 282 kilometres north-west of Melbourne, located on the Richardson River, at the junction of Sunraysia Highway and Borung Highway, in the Shire of Buloke. The town is named after William Donald, a Scottish pastoralist who was the first settler in the area in 1844.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Donald declined by 2.7% over a decade to 1,395 in 2016 below the median growth rate of -1.5% for the 14 major places analysed in the region
- 517 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 53.0% being in full-time employment and 35.6% in part-time employment
- 14.1% of the labour force classified themselves as managers, 15.7% as professionals and 10.0% as clerical and administrative workers
- 7.1% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 6.7% cited secondary education and 4.8% cited local government administration
- One public hospital is located in the town
- The town has two primary schools
- With a median age of 53, Donald is older than the median of 47 for the major places analysed in the region and above the Victorian median of 37

- The ABS report a median annual household income of $43.5K for Donald, below the median of $45.7K for the places analysed in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 64 businesses in the town or its near surrounds
- In 66.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 13.2% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 16.7% have completed level III or IV trade certificates
- another 10.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Buloke LGA had 2.5% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Donald as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

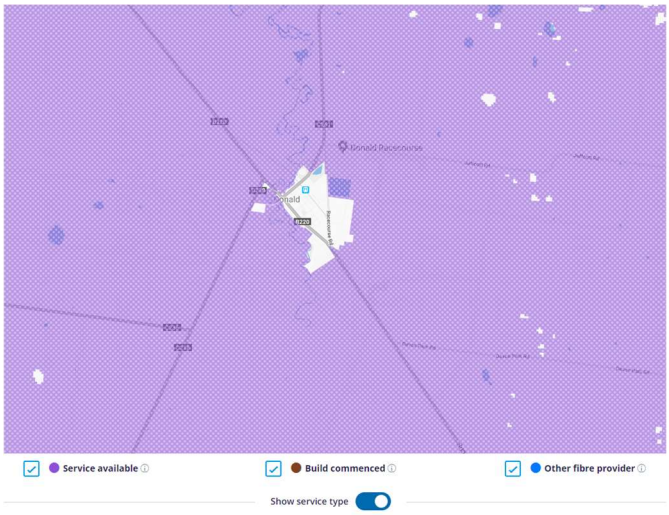

Figure 21 NBN Coverage of Donald (NBN Co)

The NBN Coverage Map above reveals that the town of Donald is only able to access NBN satellite services at the moment and does not indicate that alternative NBN services are under construction. There is good coverage of NBN fixed wireless services surrounding the town. Our analysis reveals that there is likely to be NBN fixed wireless services provided to the town in its future rollout.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows no mobile coverage in the area.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators.

LP-WAN Coverage

There is Sigfox coverage in the town.

There is Optus IoT coverage in the town.

Taggle does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.9 Town of Ouyen

Ouyen is located in the Rural City of Mildura LGA at the junction of the Calder Highway and Mallee Highway, 105 kilometres south of Mildura and 441 kilometres north-west of Melbourne. The town was established around the Ouyen railway station, built in 1906 on the Mildura Line. Ouyen is the commercial, cultural and transport centre for the surrounding grain farming region.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Ouyen declined by 1.5% over a decade to 1,045 in 2016 just below the median growth rate of -1.5% for the 14 major places analysed in the region
- 423 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 56.7% being in full-time employment and 33.3% in part-time employment
- 17.0% of the labour force classified themselves as managers, 12.9% as professionals and 10.3% as clerical and administrative workers
- 5.4% of the labour force cited their industry of employment as local government administration, 4.2% cited accommodation and 4.2% cited hospitals (except psychiatric hospitals)
- One public hospital is located in the town
- The town has a primary/secondary school and a TAFE
- With a median age of 53, Ouyen is older than the median of 47 for the major places analysed in the region and well above the Victorian median of 37
- The ABS report a median annual household income of $44.5K for Ouyen, just below the median of $45.7K for the places analysed in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 59 businesses in the town or its near surrounds
- In 62.0% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 14.0% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 16.1% have completed level III or IV trade certificates
- another 8.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mildura LGA had 4.3% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Ouyen as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

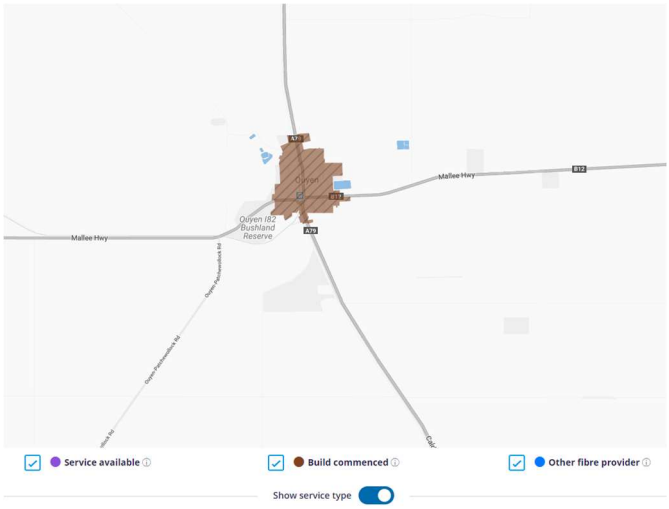

Figure 22 NBN Coverage of Ouyen (NBN Co)

The NBN Coverage Map shows that NBN fixed line services are currently under construction for Ouyen. Our analysis reveals that the town will receive a mix of NBN FTTN and FTTC. Only NBN satellite services are available outside of the NBN fixed line footprint. Examining satellite imagery of the surrounding area does not reveal significant aggregations of premises or businesses in these nearby areas.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows no mobile coverage in the area.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators.

LP-WAN Coverage

There is Taggle coverage in the town.

Sigfox does not have coverage in the town.

Optus IoT does not have coverage in the town.

Public WiFi Coverage

There is a free public WiFi zone in the Council Service Centre.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.10 Locality of Charlton

Charlton is a town in north-western Victoria 245 kilometres north-west of Melbourne. It is a small agricultural community straddling the Avoca River, located at the junction of the Calder Highway and Borung Highway and positioned in the last of the foothills of the Great Dividing Range. Its location, almost halfway between Melbourne and Mildura, makes Charlton a popular stop along the way for tourists.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Charlton declined by 10.4% over a decade to 961 in 2016 below the median growth rate of -1.5% for the 14 major places analysed in the region
- 385 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 50.6% being in full-time employment and 34.0% in part-time employment
- 14.8% of the labour force classified themselves as managers, 14.6% as professionals and 11.3% as clerical and administrative workers
- 10.3% of the labour force cited their industry of employment as combined primary and secondary education, 9.6% cited hospitals (except psychiatric hospitals) and 7.6% cited local government administration
- One public hospital is located in the town
- The town has a primary school and a primary/secondary school
- With a median age of 55, Charlton is older than the median of 47 for the major places analysed in the region and well above the Victorian median of 37
- The ABS report a median annual household income of $39.3K for Charlton, one of the lowest in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 47 businesses in the town or its near surrounds
- In 66.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 16.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.9% have completed level III or IV trade certificates
- another 9.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Buloke LGA had 2.5% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Charlton as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

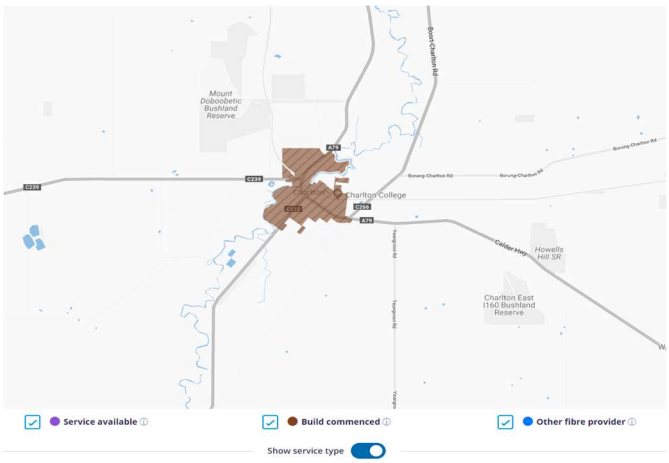

Figure 23 NBN Coverage of Charlton (NBN Co)

The NBN Coverage Map above shows that the NBN fixed line services planned for Charlton are currently under construction. Our analysis reveals that Charlton will receive an NBN FTTN rollout. The surrounding areas outside of the NBN fixed line footprint only have access to NBN satellite services. Examining satellite imagery of the surrounding areas does not reveal significant aggregations of premises or businesses in these areas.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows no mobile coverage in the area.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators.

LP-WAN Coverage

There is partial Optus IoT coverage in the town.

Taggle does not have coverage in the town.

Sigfox does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.11 Locality of Lake Boga

Lake Boga is located in north-western Victoria next to the lake of the same name within the Rural City of Swan Hill. It is situated 325 kilometres north-west of Melbourne. The surrounding area is used for agriculture including fruit and vegetable growing and grain production. There is a sizable wine grape industry in the area and one local winery.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Lake Boga grew by 9.4% over a decade to 793 in 2016 above the median growth rate of -1.5% for the 14 major places analysed in the region
- 327 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 57.8% being in full-time employment and 30.3% in part-time employment
- 15.8% of the labour force classified themselves as managers, 17.1% as professionals and 9.1% as clerical and administrative workers
- 6.9% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 4.4% cited aged care residential
- The nearest hospital is located to the north-west in Swan Hill
- The town has one primary school
- With a median age of 47, Lake Boga has the median age of the places analysed in the region, and above the Victorian median of 37
- The ABS report a median annual household income of $55.3K for Lake Boga, above the median of $45.7K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 23 businesses in the town or its near surrounds
- In 75.8% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 16.1% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 18.8% have completed level III or IV trade certificates
- another 8.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Swan Hill LGA had 3.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Lake Boga as advised by NBN Co in September 2018. The purple / striped areas show the locations currently

serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

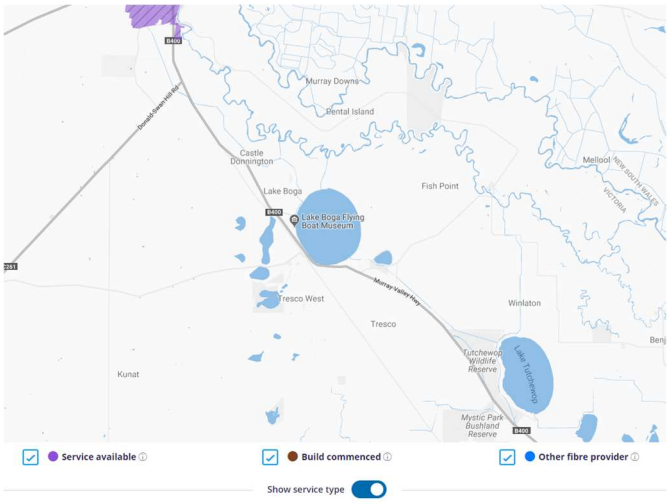

Figure 24 NBN Coverage of Lake Boga (NBN Co)

The NBN Coverage Map above shows that only NBN satellite services are available in Lake Boga, with no other services currently under construction. Our analysis reveals that NBN fixed wireless services are planned for the town in the future rollout. Analysis of business data indicates around 20 businesses located in Lake Boga town and the nearby surrounding areas.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-50 Mbps or above) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows 3G indoor and outdoor coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is partial Optus IoT coverage in the town.

Taggle does not have coverage in the town.

Sigfox does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.12 Locality of Sea Lake

Sea Lake is located in north-west Victoria in the local government area of Buloke. The town is situated on the Calder Highway, 351 kilometres north-west of Melbourne on the southern shores of Lake Tyrrell.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Sea Lake declined by 9% over a decade from 634 in 2006 to 74 in 2016, a larger decline than the median of -1.5% for the 14 major places analysed in the region
- 255 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.7% being in full-time employment and 32.4% in part-time employment
- 12.6% of the labour force classified themselves as managers, 14.8% as professionals and 9.3% as clerical and administrative workers
- 12.8% of the labour force cited their industry of employment as grain growing and 12.8% cited combined primary and secondary education
- The town has a hospital, the Sea Lake and Districts Hospital
- The town has one primary school and a secondary college
- With a median age of 53, Sea Lake is older than the median of 48 for the major places analysed in the region and older than the Victorian median of 37
- The ABS report a median annual household income of $40.4K for Sea Lake, well below Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 28 businesses in the town or its near surrounds
- In 58.4% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 7.2% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.0% have completed level III or IV trade certificates
- another 8.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Buloke LGA had 2.5% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Sea Lake as shown on the NBN Co coverage map in March 2020. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite.

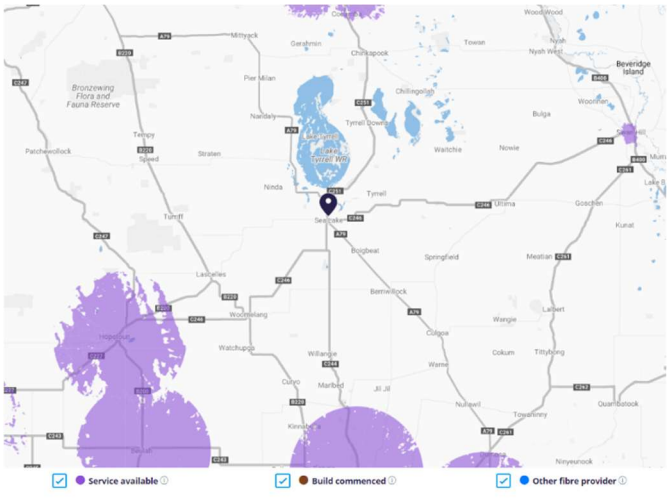

Figure 25 NBN Coverage of Sea Lake (NBN Co)

The NBN Coverage Map above shows that Sea Lake and its surrounding areas is only serviced by NBN Satellite services, meaning residents and businesses have access only to the lowest grade NBN service.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4G outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows no coverage across the entire town.

In summary, there is good mobile coverage from Telstra and Optus but none from Vodafone.

LP-WAN Coverage

There is no Sigfox coverage in the town.

Taggle does have coverage in the town.

Optus and Telstra IoT do have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.13 Locality of Cabarita

Cabarita is located in north-west Victoria in the Regional City of Mildura local government area. The town is situated around 10 kilometres from Mildura and 546 kilometres north-west of Melbourne.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Cabarita grew by 78.6% over a decade to 500 in 2016 well above the median growth rate of -1.5% for the 14 major places analysed in the region
- 255 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 56.9% being in full-time employment and 31.8% in part-time employment
- 19.0% of the labour force classified themselves as managers, 19.0% as professionals and 12.1% as clerical and administrative workers
- 6.1% of the labour force cited their industry of employment as primary education and 5.0% cited local government administration
- The nearest hospital is located nearby in Mildura
- The town has one primary school
- With a median age of 41, Cabarita is younger than the median of 47 for the major places analysed in the region but older than the Victorian median of 37

- The ABS report a median annual household income of $87.2K for Cabarita, one of the highest in the region and above Melbourne's $80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 14 businesses in the town or its near surrounds
- In 90.8% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 25.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.2% have completed level III or IV trade certificates
- another 13.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mildura LGA had 4.3% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Cabarita as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

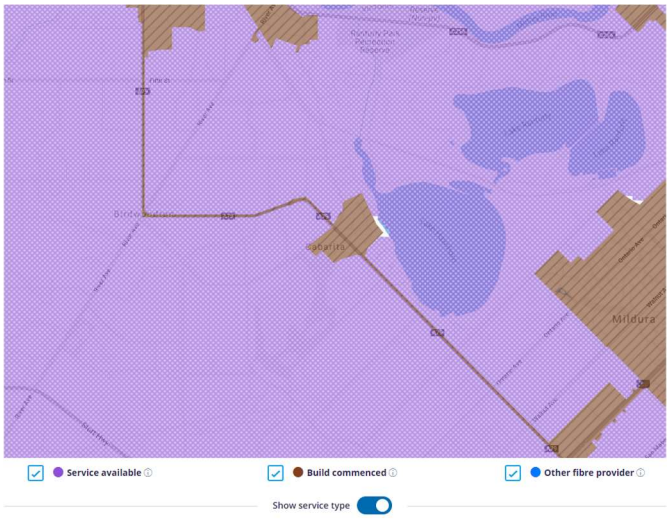

Figure 26 NBN Coverage of Cabarita (NBN Co)

The NBN Coverage Map above shows that Cabarita currently has its NBN fixed line services under construction. Our analysis reveals that Cabarita will receive an NBN FTTN rollout. Outside the NBN fixed line footprint there is good coverage of NBN fixed wireless services.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows 4G indoor and outdoor coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

LP-WAN Coverage

There is Sigfox coverage in the town.

Taggle does not have coverage in the town.

Optus IoT does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

3.14 Locality of Leitchville

Leitchville is a town in northern Victoria. The town is in the Shire of Gannawarra local government area, 262 kilometres north-west of Melbourne. The district was named after the manager of Gunbower station, Duncan Leitch, following his death in 1887. The major industry in Leitchville is dairy production.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Leitchville declined by 7.0% over a decade to 252 in 2016 below the median growth rate of -1.5% for the 14 major places analysed in the region
- 93 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 61.3% being in full-time employment and 31.2% in part-time employment
- 7.5% of the labour force classified themselves as managers, 5.4% as professionals and 12.9% as clerical and administrative workers
- 15.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- The nearest hospital is located in Cohuna to the north-west
- The town has one primary school
- With a median age of 53, Leitchville is older than the median of 47 for the major places analysed in the region and well above the Victorian median of 37
- The ABS report a median annual household income of $45.7K for Leitchville, the median income of the major places analysed in the region
- Data in SLIM on businesses registered with Workcover indicates approximately 31 businesses in the town or its near surrounds
- In 65.7% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 6.0% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.6% have completed level III or IV trade certificates
- another 6.5% have completed year 12.

ABS Industry employment data from 2016 indicated that the Gannawarra LGA had 3.2% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Leitchville as advised by NBN Co in September 2018. The purple / striped areas show the locations currently serviced by NBN fixed line services, the purple / spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown / striped areas show the locations where NBN fixed line services are planned or under construction.

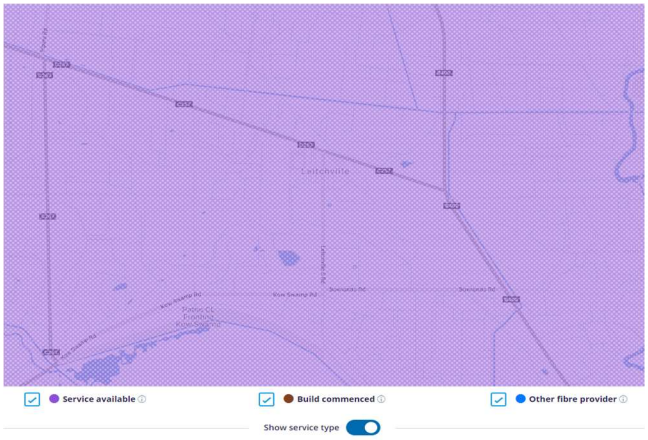

Figure 27 NBN Coverage of Leitchville (NBN Co)

The NBN Coverage Map above shows that Leitchville and the surrounding areas are served by NBN fixed wireless services. There is consistent coverage throughout these areas.

The overarching report contains a discussion of the limitations associated with the different NBN Co access network technologies.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town
- Optus shows 4G Plus outdoor coverage across the entire town
- Vodafone shows no mobile coverage in the area.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators.

LP-WAN Coverage

There is partial Optus IoT coverage in the town.

Taggle does not have coverage in the town.

Sigfox does not have coverage in the town.

Public WiFi Coverage

There are no known public WiFi zones in the town but, free WiFi access is available at the library during library hours.

Other

The city is neither on the VicTrack or the power transmission fibre routes.

4 Primary Production

4.1 Land Use Classification

The Victorian Land Use Information System sub-classifies primary production land use in the categories shown on the map below.

As is evident from the land use map following, the overwhelming categorization of land across the region is classified as Cropping, however the region a major producer of fruit and nuts, shown as Horticulture. LGA boundaries are overlaid in red.

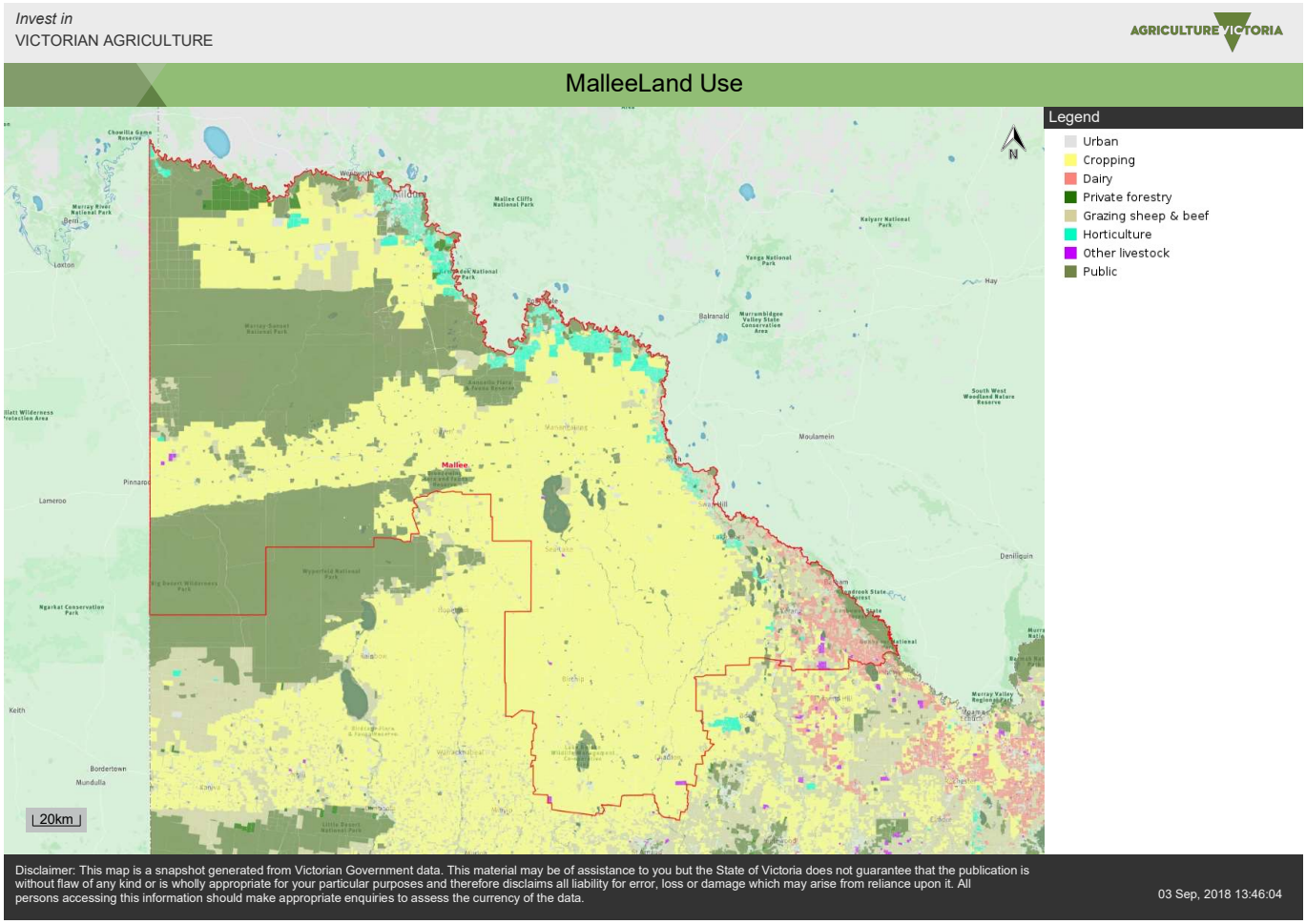

Figure 28 Primary production land in the Region (Agriculture Victoria)

The character of digital needs and opportunities will inevitably vary for different types of agriculture. By way of just a few examples:

- in livestock production areas, detailed animal tracking, identification, biometrics and feed management can optimise yields
- in cropping areas, technology for real-time machinery monitoring and guidance is becoming more common, and satellite imagery can provide valuable insights into crop development and health
- in irrigation areas, soil moisture monitoring and water management are becoming increasingly important to minimise costs and maximise production
- in all areas, general access to information *where* and *when* it is needed can support informed decision-making

- with agriculture posing many occupational health and safety risks, access to communications in emergency situations can make the difference between life and death.

In the light of this, all forms of agriculture will need to exploit information technology and communications more actively in the future if they are to remain globally competitive.

Accordingly, it is relevant to consider the supply of fixed broadband *(important at homesteads and business locations in rural land*), mobile coverage (*for both voice and data communications*) and LP-WAN coverage (*for emerging IoT applications*).

4.2 Fixed Broadband Supply

NBN Services

The map below shows NBN coverage of the Mallee region.

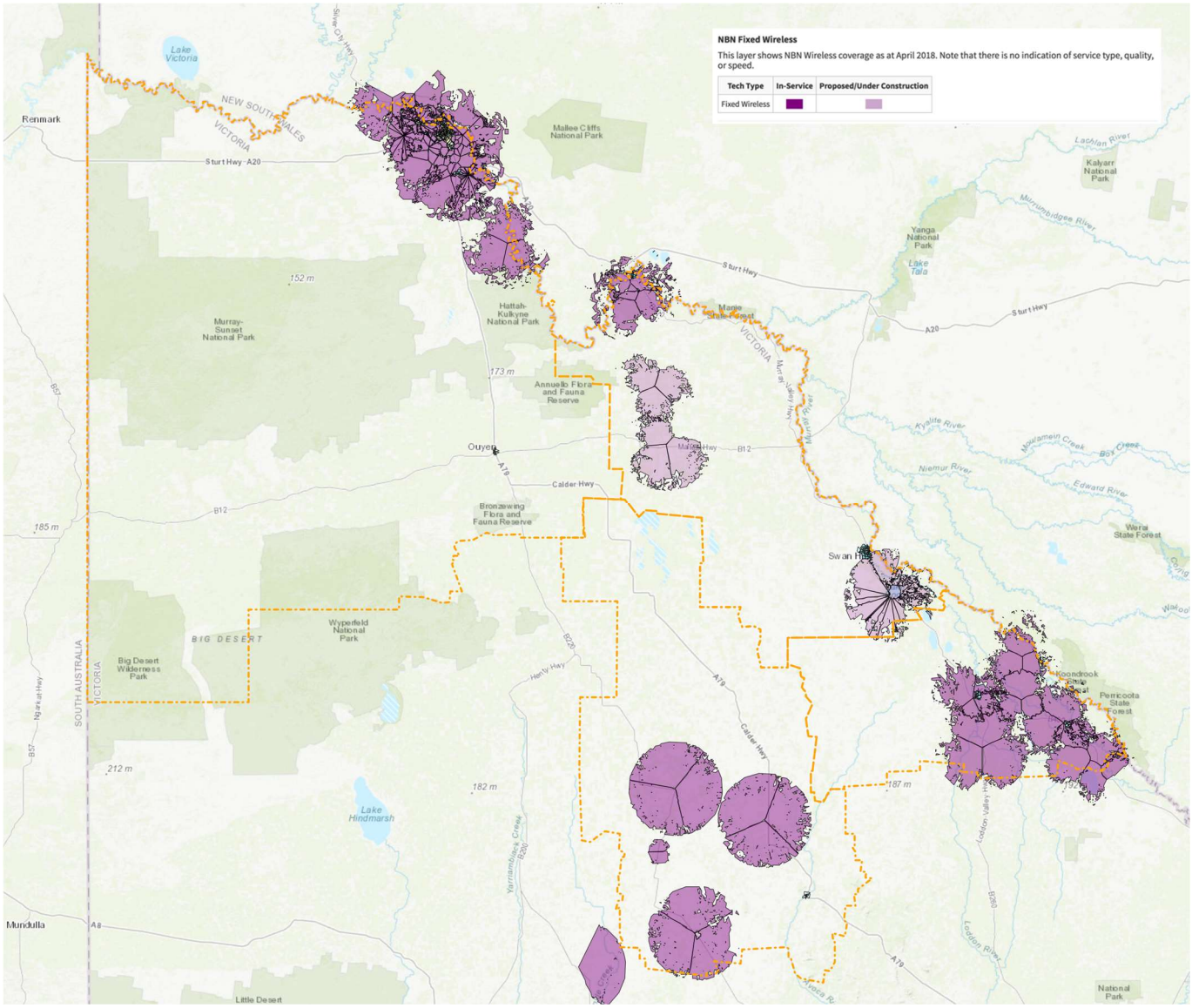

Figure 29 NBN Co Coverage of the Mallee Region (SLIM)

The most significant feature is the split between fixed wireless coverage (in purple) and the areas with satellite coverage (no colour). Technologies such as FTTP, FTTC and FTTN are barely visible at the scale of this map – but since these technologies are limited to

population centres, they are only marginally relevant to an analysis of primary production land.

Overall, by simple visual estimation, it appears that around 80% of rural land in the Mallee has access to NBN Co's satellite solution, and most of the remainder has access to (or is due to receive) the higher-performing fixed wireless solution.

By Local Government Area, the indicative percentage of the area of rural land with satellite coverage shown in the table following.

LGA	Population in Rural Land[14]	Estimated Area of Satellite Coverage
Buloke	1,943	60%
Gannawarra	4,620	80%
Mildura	12,335	95%
Swan Hill	6,065	90%

Note that the rural population is not necessarily evenly distributed across the rural land, and therefore the number of homes and businesses in NBN Co's satellite footprint does not necessarily correlate with the proportion of satellite coverage by land area.

Horticulture

- *Fruit / nuts*
- *Area around Mildura*

The map below shows NBN fixed wireless coverage within a range of around 15-20 kilometres from Mildura city centre. Beyond this footprint farms only have access to NBN satellite, except for the area to the south-east of the city where there is more NBN fixed wireless coverage around Nangiloc and Colignan.

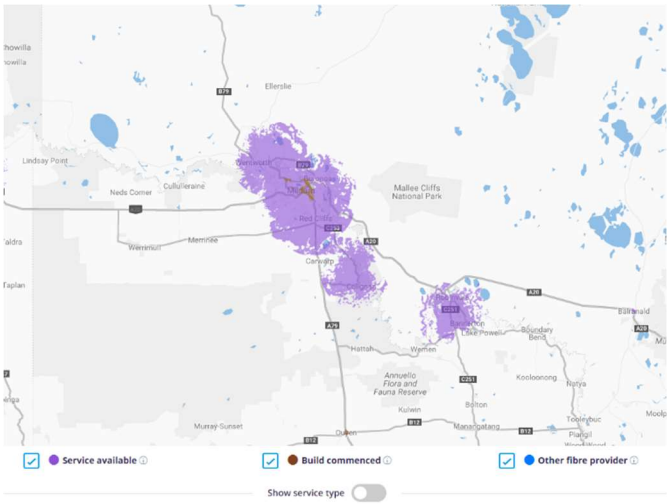

Figure 30 NBN Coverage of the horticulture area around Mildura (NBN Co)

Horticulture

- *Fruit / nuts*
- *Area around Robinvale*

The map below shows pretty consistent NBN fixed wireless coverage south of Robinvale to a range of around 15 kilometres to 20 kilometres. Beyond this range farms are only able to access NBN satellite services.

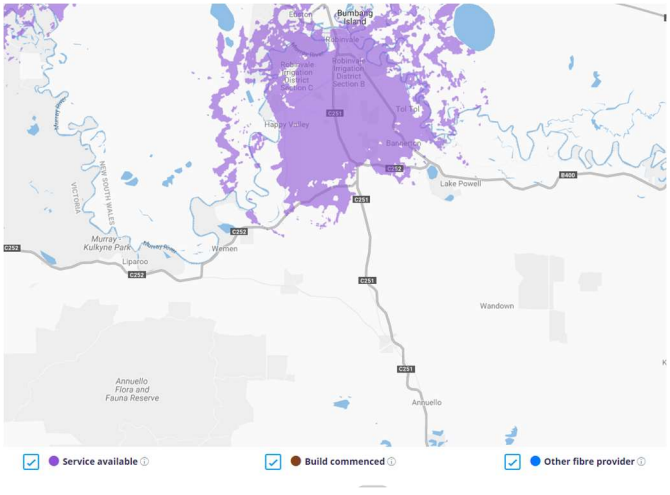

Figure 31 NBN Coverage of the horticulture area south of Robinvale (NBN Co)

[14] The number of individuals living in rural areas is estimated by subtracting the number in cities, towns and localities with a population greater than 185 from the total population in the LGA.

Horticulture

- *Fruit / nuts*
- *Area around Swan Hill*

The map below shows farms around Swan Hill are only able to access NBN satellite services at this time. The Swan Hill town is provisioned with NBN FTTN services with no NBN fixed wireless services in the surrounding areas.

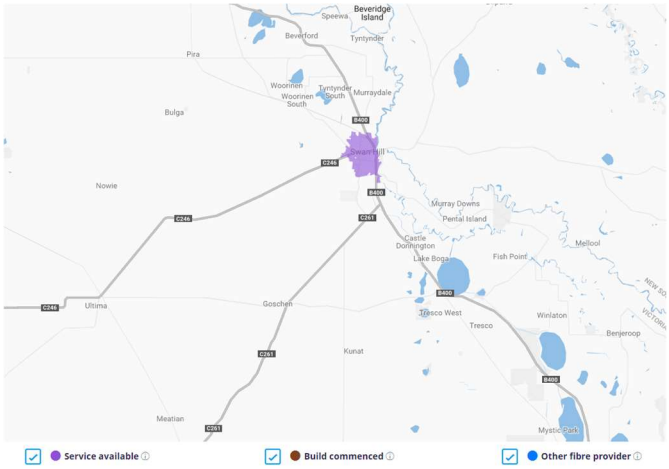

Figure 32 NBN Coverage of the horticulture area around Swan Hill (NBN Co)

Grazing

- *Dairy*
- *The area around Cohuna*

The map below shows quite good coverage of NBN fixed wireless services in the areas surrounding Cohuna. NBN fixed wireless services begin to get patchy around 5 kilometres to 10 kilometres to the south-west of the Cohuna town centre.

Farms located closer in proximity to Horfield, Wee Wee Rup and Leitchville have NBN fixed wireless coverage with patchy coverage around McMiltans and Milnes Bridge.

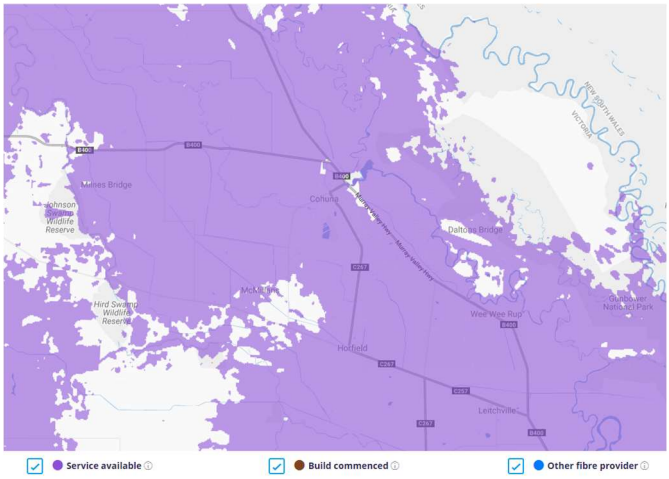

Figure 33 NBN Coverage of the grazing area around Cohuna (NBN Co)

Cropping

- *Grains*
- *The area north of Birchip*

The map below shows NBN fixed wireless coverage within a range of around 15 kilometres around the town centre of Birchip. Farms beyond this range to the north are serviced by NBN satellite without nearby populations centres serviced by NBN fixed wireless.

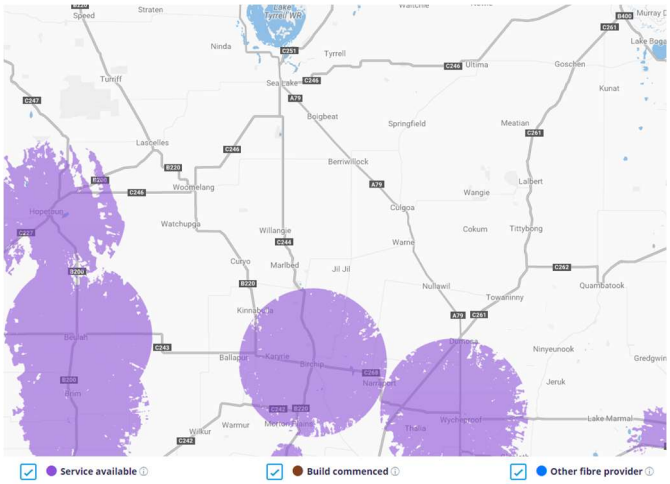

Figure 34 NBN Coverage of the cropping area around Birchip (NBN Co)

Cropping

- *Grains*
- *The area west of Ouyen*

The map below shows that farms to the west of Ouyen have no access to NBN fixed wireless services at the moment, serviced only by NBN satellite.

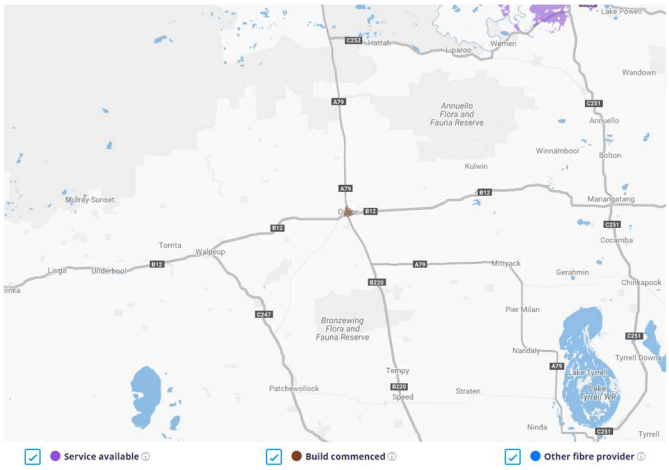

Figure 35 NBN Coverage of the cropping area west of Ouyen (NBN Co)

Other fixed Connectivity Options

For those living in rural areas where satellite is the only technology supported by NBN Co, there are several noteworthy technology alternatives:

- Wireless technologies (microwave and enhanced WiFi configured for long-reach) can be used to extend capacity from an area with better service
- The mobile network operators are starting to introduce plans with high data allowances that may substitute or augment a satellite service
- Other providers (notably Telstra) may be able to provide a service.

More detailed information on local areas – down to the level of individual businesses can be obtained using SLIM – as illustrated in the map following showing the area around Ararat, used as an example only.

In this map:

- green areas show individual agricultural land parcels
- purple areas show NBN fixed wireless coverage

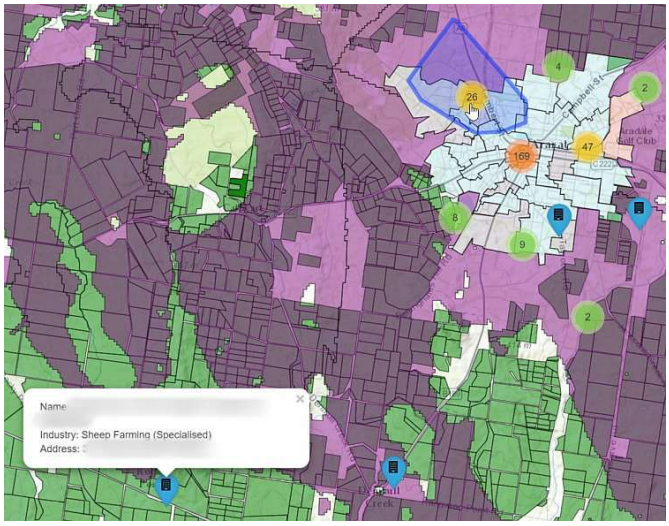

Figure 36 SLIM outputs at a more detailed level (SLIM)

- the "popup" at the bottom left shows details of an individual sheep farming business at the location marked with the blue marker
- the coloured circles indicate the number of businesses in an area
- the hand-shape pointer touching on the circle with the number "26" is lighting up (with blue boundary and shading) the area within which those 26 businesses are located.

4.3 Mobile Coverage

Simple visual examination of these maps of Telstra and Optus suggest extensive coverage across the Mallee region, with most coverage gaps confined to areas far from highways and population centres, national and state parks.

In contrast, Vodafone's coverage is more limited, concentrating on significant population centres and major national roads.

Looking to the future, the ability of the mobile networks to support agricultural IoT applications will be enhanced by the activation of the NB-IoT and Cat-M1 protocols, and by the advent of 5G. The mobile network operators' plans for regional areas are not known.

Horticulture

- *Fruit / nuts*
- *Area around Mildura*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows continuous 4GX and 3G outdoor handheld device coverage across the area
- Optus shows continuous 4G Plus and 3G outdoor coverage across the area
- Vodafone shows continuous 4G and 3G outdoor coverage across the area.

In summary, there is mobile coverage in the area with coverage provided by all three mobile network operators .

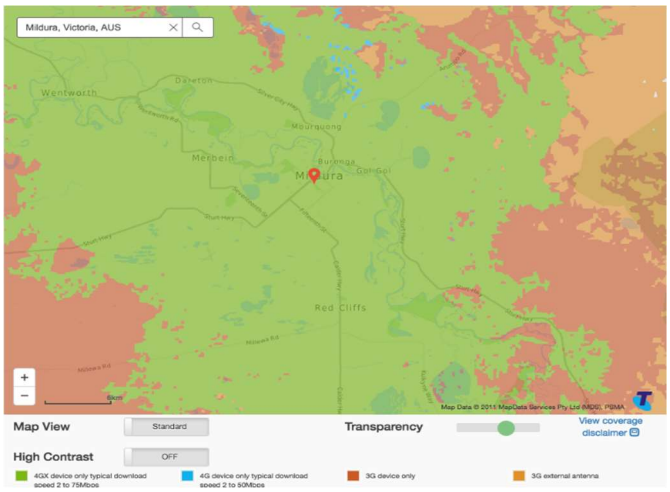

Figure 37 Telstra mobile coverage around Mildura

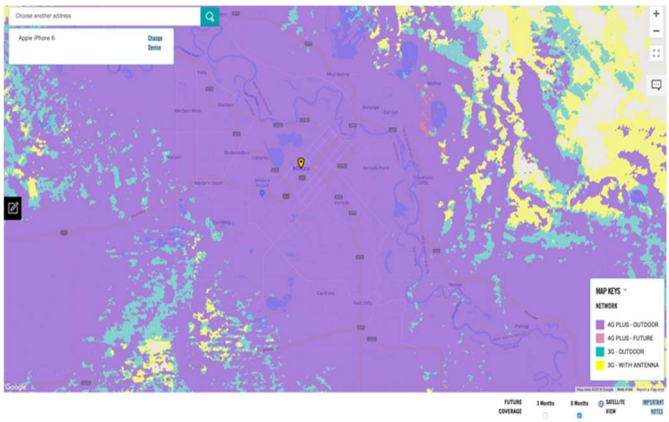

Figure 38 Optus mobile coverage around Mildura

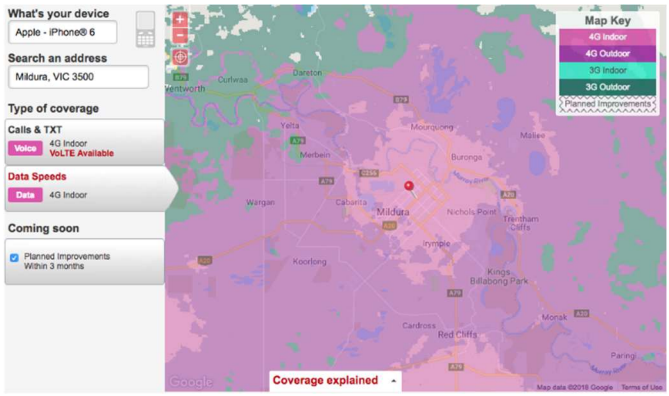

Figure 39 Vodafone mobile coverage around Mildura

Horticulture

- *Fruit / nuts*
- *Area around Robinvale*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage in the immediate area around Robinvale, however coverage then reverts to 3G external antenna
- Optus similarly shows 4G Plus and 3G outdoor coverage across the area, with significant areas of 3G external antenna and no coverage in all directions
- Vodafone shows continuous 4G and 3G outdoor coverage along the Sturt Highway but no coverage beyond that corridor.

In summary, there is mobile coverage in the immediate area around Robinvale, but coverage quickly falls away within a ~10 kilometre radius to provide external antenna or no coverage.

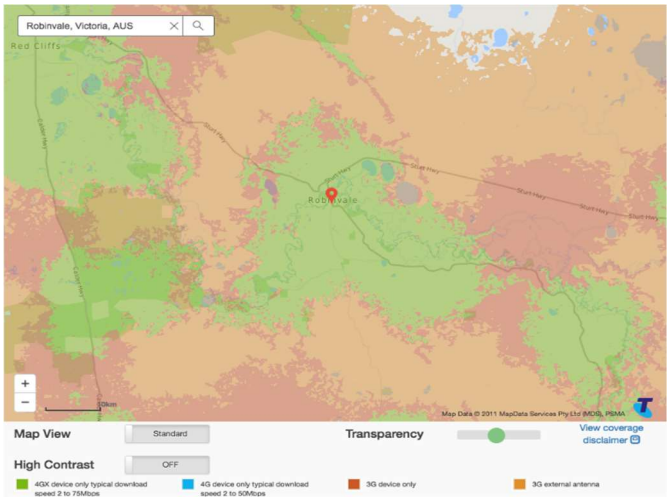

Figure 40 Telstra mobile coverage around Robinvale

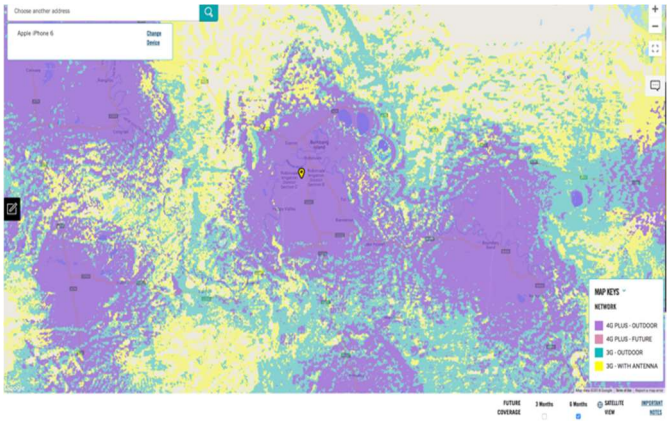

Figure 41 Optus mobile coverage around Robinvale

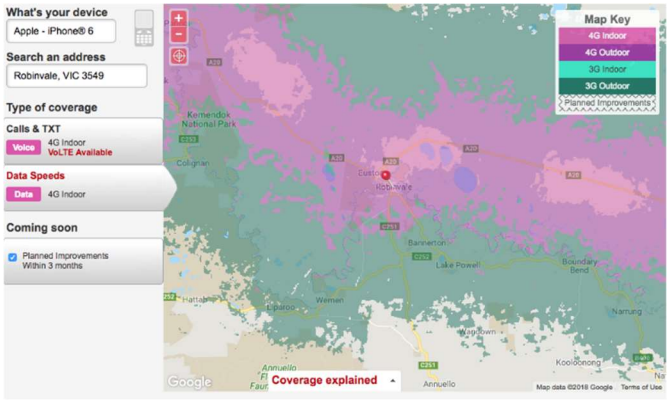

Figure 42 Vodafone mobile coverage around Robinvale

Horticulture

- *Fruit / nuts*
- *Area around Swan Hill*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage along the Murray Valley Highway, but coverage falls away to 3G device and external antenna coverage to the east and west of the highway corridor
- Optus shows 4G Plus outdoor coverage along the Murray Valley Highway but coverage falls away to 3G handheld device and 3G external antenna coverage to the east and west of the highway
- Vodafone shows continuous 4G outdoor coverage in a circle area around Swan Hill as far as Murray Downs, but coverage then falls away to 3G and no coverage at all. Vodafone is constructing new 4G coverage on the Murray Valley Highway near Beverford.

In summary, there is mobile coverage in the immediate area around Swan Hill and along the Murray Valley Highway, but coverage quickly falls away within a ~10 kilometre radius to provide external antenna or no coverage.

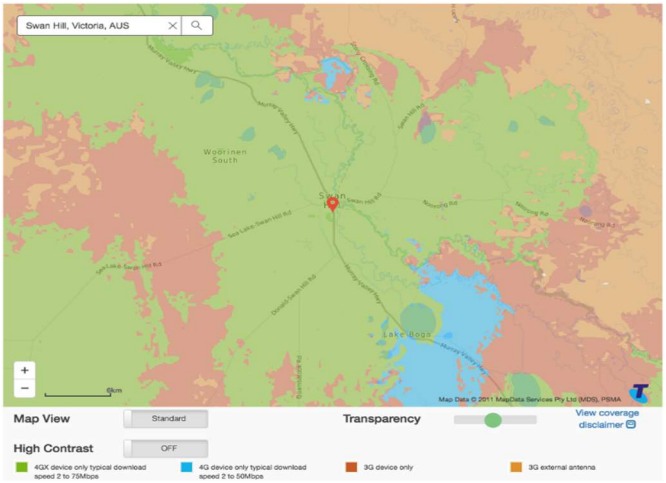

Figure 43 Telstra mobile coverage around Swan Hill

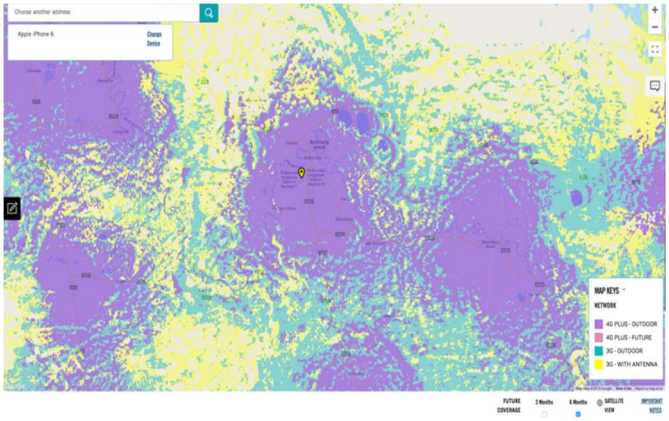

Figure 44 Optus mobile coverage around Swan Hill

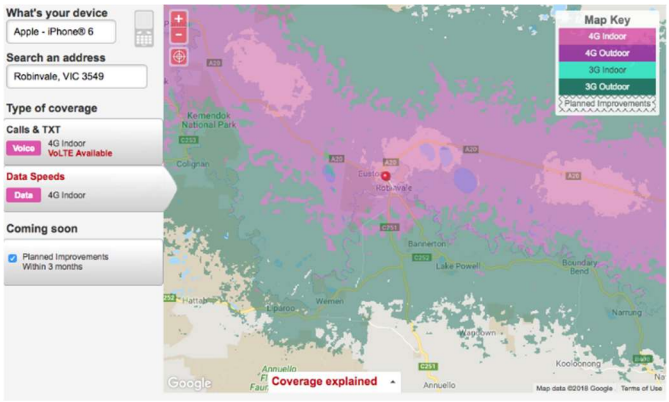

Figure 45 Vodafone mobile coverage around Swan Hill

Grazing

- *Dairy*
- *The area around Cohuna*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows continuous 4GX and 3G outdoor handheld device coverage across the area
- Optus shows continuous 4G Plus and 3G outdoor coverage on the Victorian side of the Murray River
- Vodafone shows some 3G outdoor coverage to the west of Cohuna, however this would be considered marginal at best. East of Cohuna shows no coverage.

In summary, there is mobile service in the area from two mobile network operators , although in many areas it would be characterised as 'marginal'.

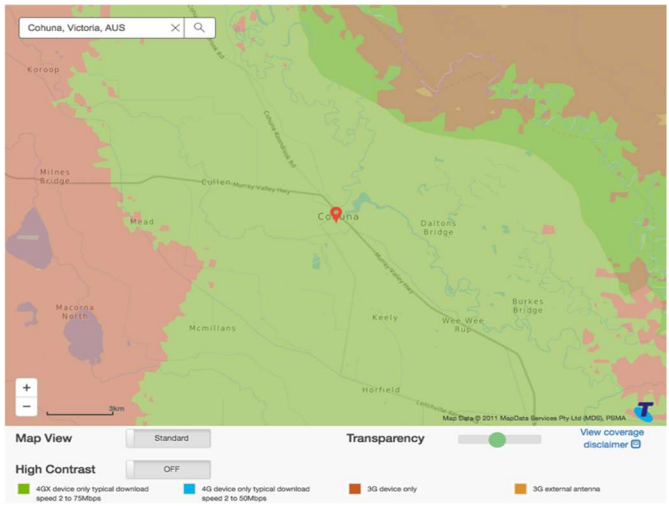

Figure 46 Telstra mobile coverage around Cohuna

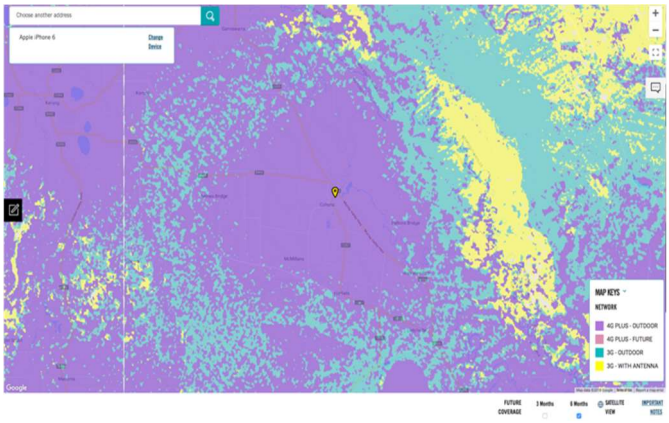

Figure 47 Optus mobile coverage around Cohuna

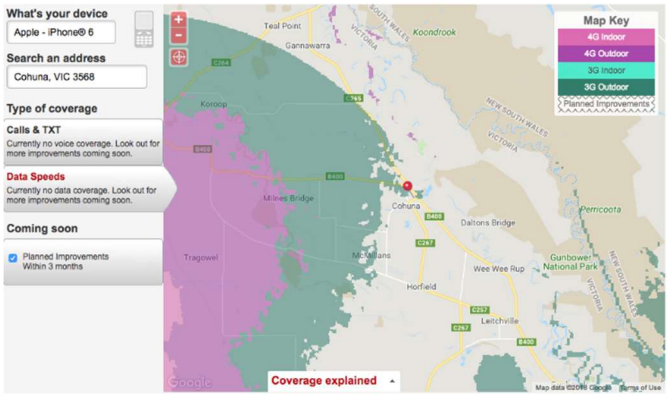

Figure 48 Vodafone mobile coverage around Cohuna

Cropping

- *Grains*
- *The area north of Birchip*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows patchy 4GX and 3G outdoor handheld device coverage, however there are large areas of 3G external antenna coverage only
- Optus shows continuous 4G Plus and 3G outdoor coverage in the area
- Vodafone shows no coverage in the area.

In summary, there is continuous mobile service in the area from one mobile network operator only, with partial device coverage by a second operator.

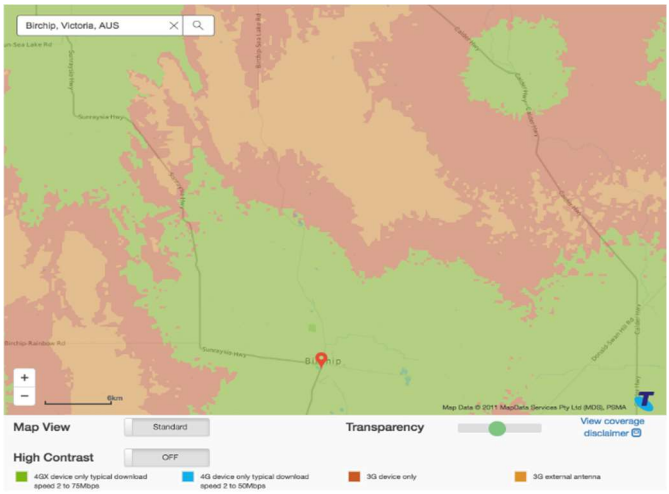

Figure 49 Telstra mobile coverage north of Birchip

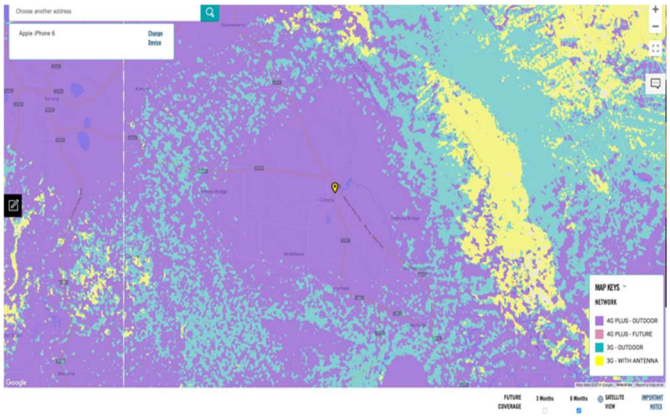

Figure 50 Optus mobile coverage north of Birchip

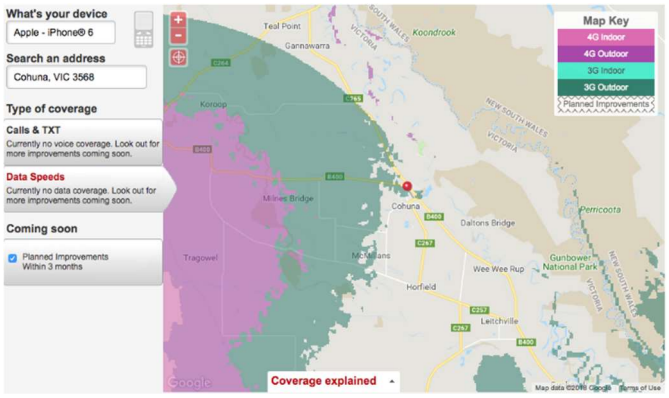

Figure 51 Vodafone mobile coverage north of Birchip

Cropping

- *Grains*
- *The area west of Ouyen*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows patchy 4GX and 3G outdoor handheld device coverage, however there are large areas of 3G external antenna coverage only
- Optus shows continuous 4G Plus and 3G outdoor coverage in the area
- Vodafone shows no coverage in the area.

In summary, there is no continuous mobile device service in the area, with only partial coverage by two mobile network operators.

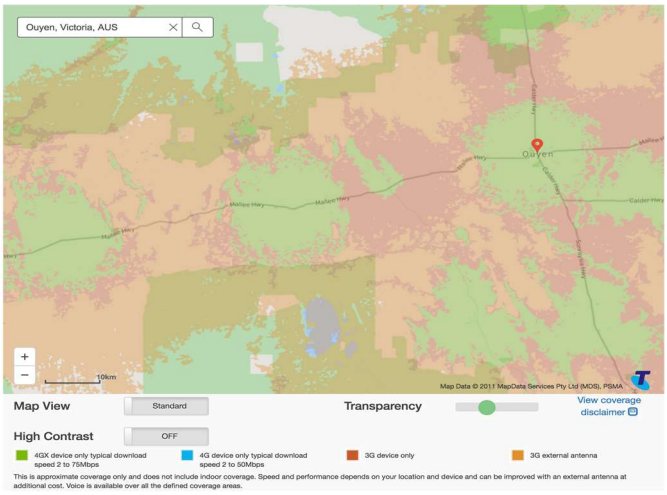

Figure 52 Telstra mobile coverage west of Ouyen

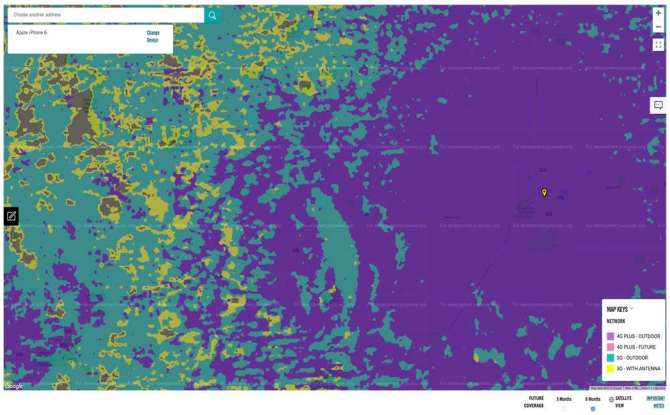

Figure 53 Optus mobile coverage west of Ouyen

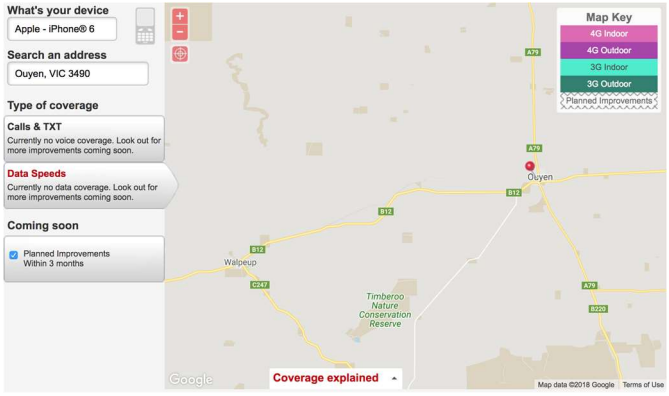

Figure 54 Vodafone mobile coverage west of Ouyen

4.4 LP-WAN Coverage

Coverage maps for two of three major LP-WAN technologies (Sigfox and Taggle) are provided in **Section 2.3**. Coverage of the third major LP-WAN technology (LoRa) is unknown.

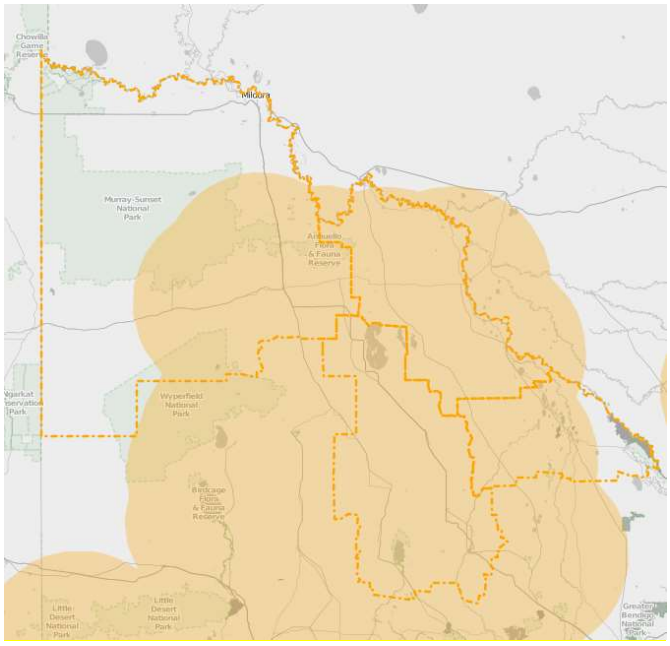

Figure 55 Taggle IoT Coverage in Mallee

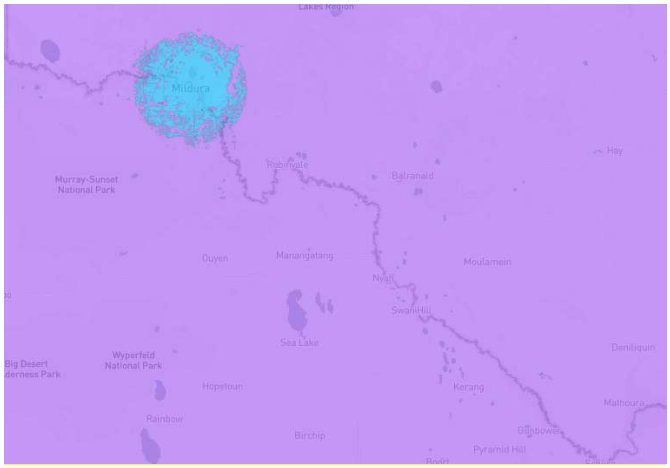

Figure 56 Sigfox IoT Coverage in Mallee

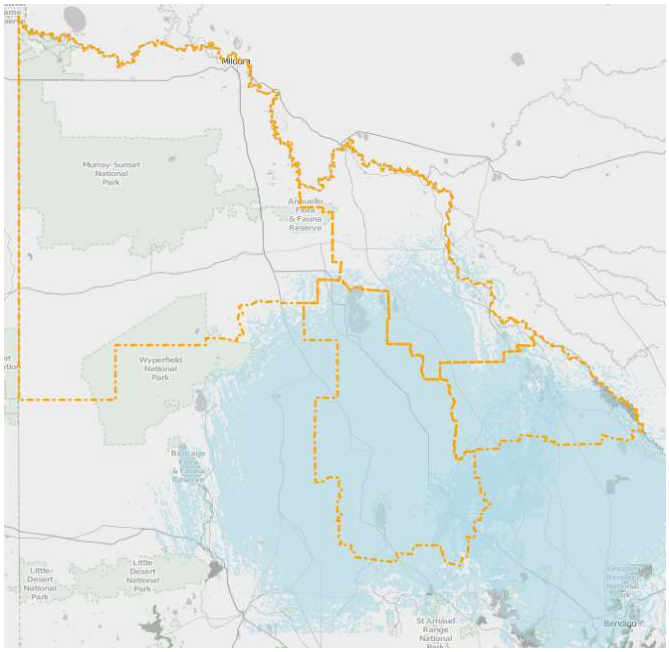

Figure 57 Optus NB IoT Coverage in Mallee

Based on these maps:

- Sigfox coverage is currently available in the Mildura region only
- Extensive Taggle coverage appears to be available in the Buloke and Swan Hill LGAs, most of Gannawarra and the south eastern areas of the Mildura region around Ouyen
- Optus NB IoT coverage is primarily available in the Buloke and Gannawarra regions with partial coverage in the southern fringes of the Swan Hill LGA around Ultima.

In areas towards the fringes of coverage footprints, testing is necessary to confirm the viability of communications connectivity. If it is marginal, better antennas and antenna positioning may help, or the installation of additional base stations may be necessary to get reliable communications.

Agricultural IoT trials currently being undertaken may yield further insight into needs, opportunities and barriers in the adoption of IoT technologies.

Horticulture

- *Fruit / nuts*
- *Area around Mildura*

Sigfox maps show extensive coverage is available Mildura.

The Optus NB-IoT trials and Taggle IoT maps show no coverage in the area.

Horticulture

- *Fruit / nuts*
- *Area around Robinvale*

There is Taggle IoT coverage approximately 3-5 kilometres south of Robinvale. Testing should be conducted to determine exact coverage in the area.

The SLIM database and public maps for Sigfox, and the Optus NB-IoT trials show no coverage in the area.

Horticulture

- *Fruit / nuts*
- *Area around Swan Hill*

There is extensive Taggle IoT coverage in the Swan Hill region with limited Optus NB IoT coverage is available. Testing should be conducted to determine exact coverage in the area.

Sigfox is not currently available in the Swan Hill region.

Grazing

- *Dairy*
- *The area around Cohuna*

There is limited Optus NB IoT coverage is available. Testing should be conducted to determine exact coverage in the area.

The SLIM database and public maps for Sigfox and Taggle IoT show no coverage in the area.

Cropping

- *Grains*
- *The area north of Birchip*

There is extensive Taggle IoT coverage in the Birchip region.

Sigfox and Optus NB IoT are not currently available in the region.

Cropping

- *Grains*
- *The area west of Ouyen*

There is extensive Taggle IoT coverage in the Ouyen region.

Sigfox and Optus NB IoT are not currently available in the region.

4.5 Skills

No specific information regarding the skill level of those operating businesses or living in agricultural areas is currently available.

An *indirect* indicator of skillsets useful in taking advantage of digital technologies *may* be found in general education levels.

Across the Mallee region, ABS Quickstats data indicates the proportions of the population with an educational attainment of Year 12 or higher (Level III or IV certificate, Diploma or Advanced Diploma, Bachelors degree or above) as shown in the table following.

LGA	Population	% Year 12+
Buloke	6,151	43.8%
Gannawarra	10,563	42.2%
Mildura	55,071	51.1%
Swan Hill	20,849	44.6%
Region	**92,634**	**48.1%**

5 Tourist Locations

For tourist locations, the communication demands tend to comprise:

- the needs of the host, predominantly comprising fixed broadband connectivity; and
- the needs of tourists visiting the region, predominantly comprising mobile connectivity and potentially WiFi connectivity in the surrounding towns or at accommodation venues.

The communications options for population centres across the region are discussed in **Section 3** Significant Places, and an overview of mobile coverage outside these centres is provided in **Section 2.2** Mobile coverage.

For major events, mobile coverage is a primary concern, not just for the event venue itself, but also for the surrounding area. Visitors increasingly rely on network access for purposes such as navigation.

Note the Mallee Region features numerous additional tourist attractions and events beyond those covered in this section.

5.1 Lake Tyrrell

Lake Tyrrell is Victoria's largest salt lake spanning 20,860 hectares located 7 kilometres north of the town of Sea Lake, accessible from the Calder Highway.

The lake is covered by shallow water, but it is dry for most of the year. The area around the lake is home to wildlife such as emus, kangaroos and reptiles. There is an information bay and viewing platform at the lake.

Figure 58 Salt formations at Lake Tyrrell[15]

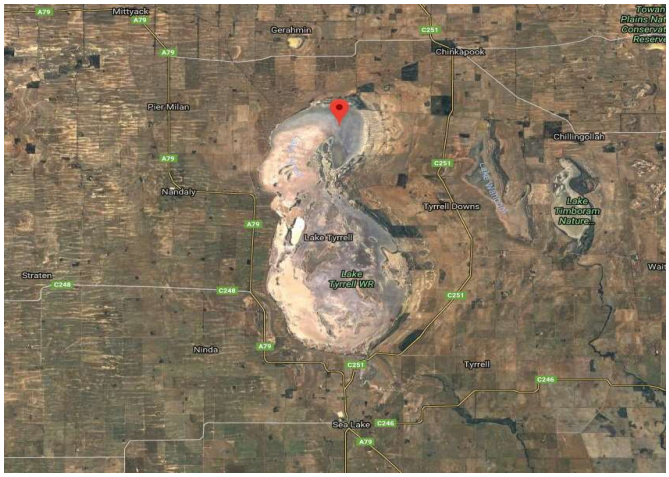

Figure 59 Aerial imagery of Lake Tyrrell

Fixed Broadband

Our analysis reveals Lake Tyrrell falls into the NBN satellite footprint.

[15] https://www.visitmelbourne.com/regions/grampians/things-to-do/nature-and-wildlife/lakes-and-waterways/lake-tyrrell

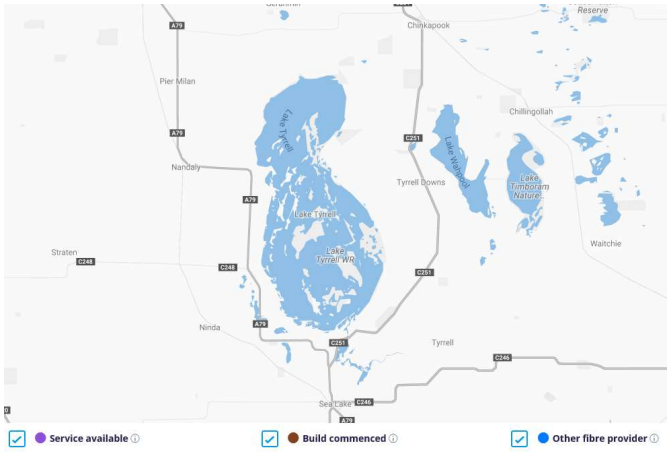

Figure 60 NBN Coverage of Lake Tyrrell (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) and 3G device coverage of the lake
- Optus shows 4G Plus outdoor and 3G outdoor coverage of the lake
- Vodafone shows no coverage of the lake.

In summary, there appears to be good coverage of the lake from two of the three mobile network operators.

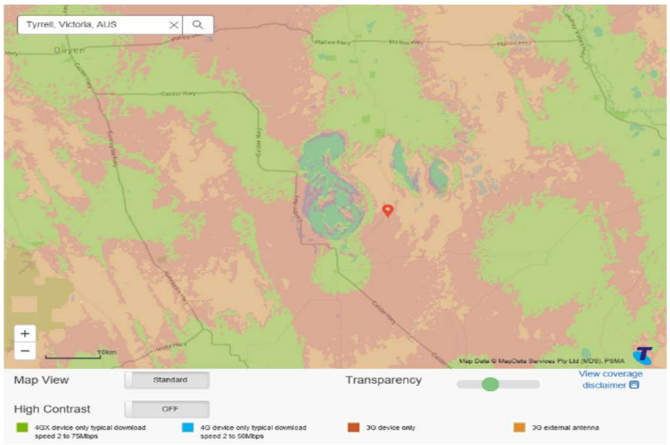

Figure 61 Telstra mobile coverage of Lake Tyrrell

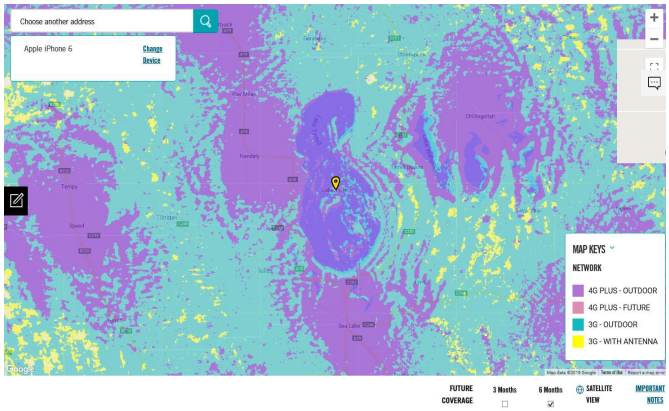

Figure 62 Optus mobile coverage of Lake Tyrrell

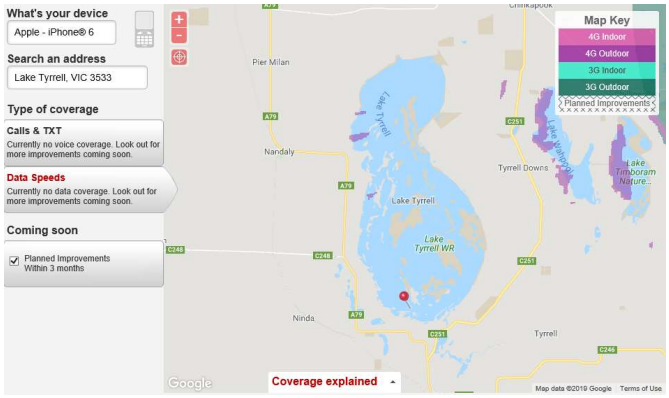

Figure 63 Vodafone mobile coverage of Lake Tyrrell

5.2 Wooroonook Lakes Campground

Located on the edge of Wooroonook Lakes is the Wooroonook Lakes Campground with 12 powered sites and numerous non-powered sites. The campground is complete with showers, flushing toilets, brake drum fireplaces and picnic tables.

The lake nearby is safe for swimming and several fishing spots are accessible from the campsite.

Figure 64 Campground at Wooroonook Lakes[16]

Fixed Broadband

Our analysis reveals the Wooroonook Lakes Campground falls into the NBN satellite footprint.

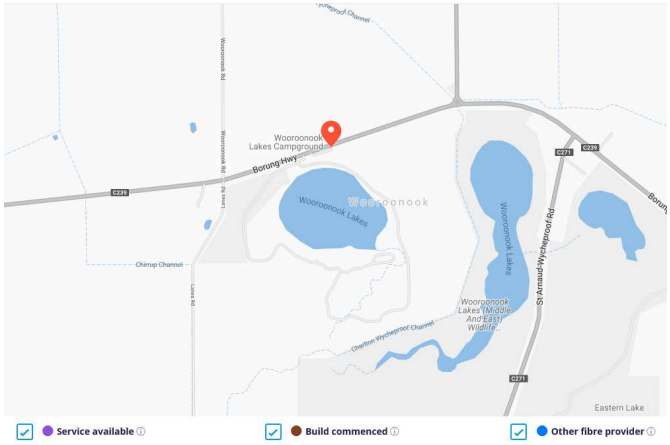

Figure 65 NBN Coverage of Wooroonook Lakes (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 3G device coverage of the campground
- Optus shows 3G outdoor coverage of the campground. The surrounding area has 4G Plus and 3G outdoor coverage.
- Vodafone shows no coverage of the campground.

In summary, there appears to be 3G outdoor device coverage of the campground from two of the three mobile network operators.

Figure 66 Telstra mobile coverage of Wooroonook Lakes Campground

Figure 67 Optus mobile coverage of Wooroonook Lakes Campground

[16] http://www.findacamp.com.au/camp-site.php?camp=1684

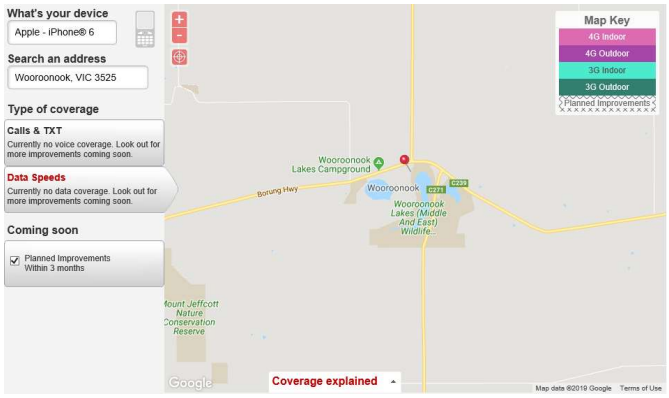

Figure 68 Vodafone mobile coverage of Wooroonook Lakes Campground

5.3 Mount Wycheproof

Mount Wycheproof is the smallest registered mountain in Australia, rising approximately 43 metres above the surrounding plains.

It is located in the town of Wycheproof with the unique mineral substance Wycheproofite exclusive to the area. There are several walking tracks where wildlife such as emus and kangaroos can be sighted. Accommodation is available in the town at the local pubs, caravan park and motel.

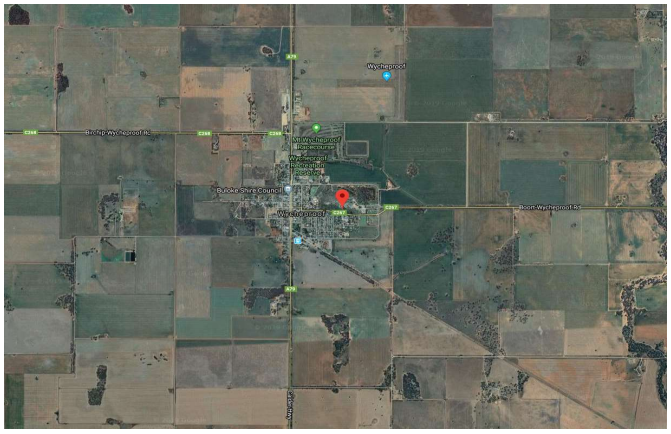

Figure 69 Aerial imagery of Mount Wycheproof

Figure 70 Mount Wycheproof[17]

Fixed Broadband

Our analysis reveals the town of Wycheproof is serviced by NBN fixed Wireless.

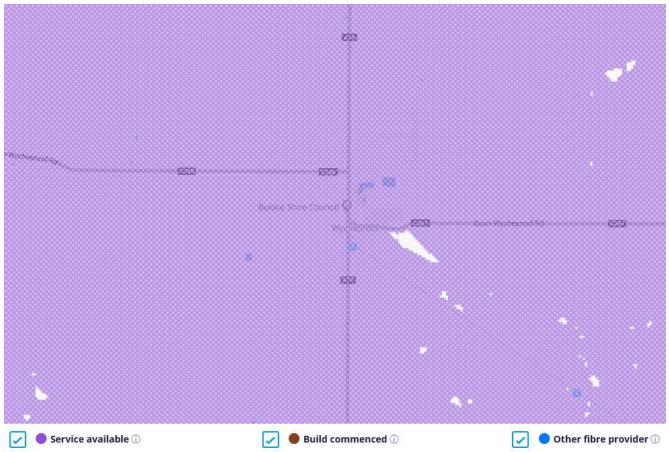

Figure 71 NBN Coverage of the town of Wycheproof (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the town including Mount Wycheproof
- Optus shows 4G Plus outdoor coverage of the town including Mount Wycheproof
- Vodafone shows no coverage of the town including Mount Wycheproof.

In summary, there appears to be good coverage of the town and mountain from two of the three mobile network operators.

[17] https://unofficialnetworks.com/2018/06/13/mt-wycheproof-world-smallest-mountain/

Figure 72 Telstra mobile coverage of Mount Wycheproof

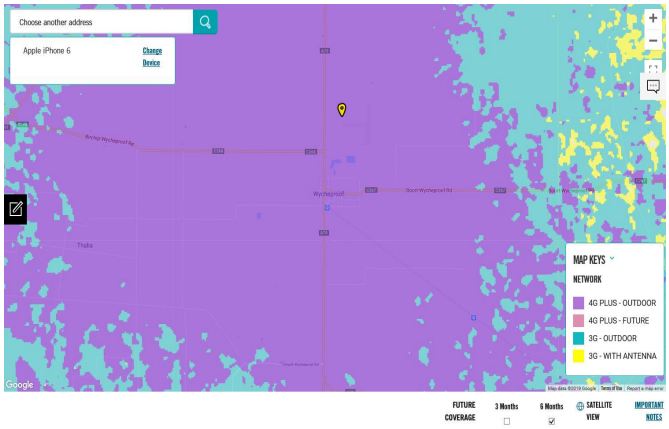

Figure 73 Optus mobile coverage of Mount Wycheproof

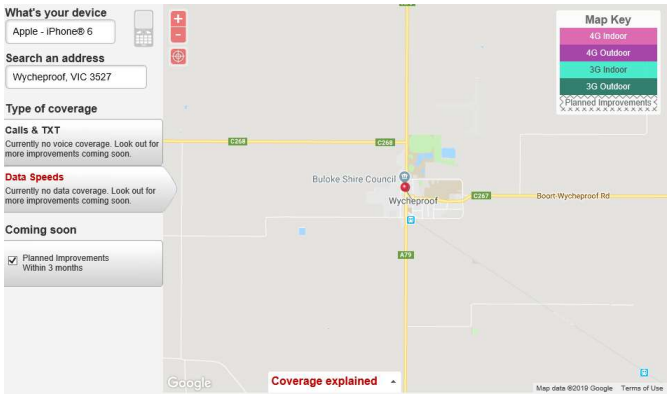

Figure 74 Vodafone mobile coverage of Mount Wycheproof

5.4 Gateway to Gannawarra Visitor Centre

The Gateway to Gannawarra Visitor Centre, located on King George St in Cohuna, is a worthwhile stop for visitors to gain information on attractions in the region. The centre has helpful staff, informative maps and photos to enhance the time experienced in the area. Local produce is also on display and available to purchase in the centre.

Figure 75 The Gateway to Gannawarra Visitor Centre[18]

Fixed Broadband

Our analysis reveals the Gateway to Gannawarra Visitor Centre is serviced by NBN FTTN fixed line.

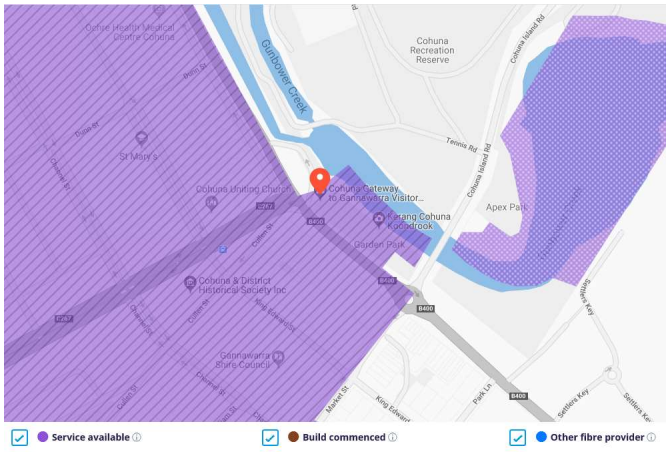

Figure 76 NBN Coverage of the Gateway to Gannawarra Visitor Centre (NBN Co)

Mobile Coverage

Based on public coverage maps:

[18] https://www.visitkerangcohunakoondrook.com.au/gateway-to-gannawarra-visitor-centre

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the centre
- Optus shows 4G Plus outdoor coverage of the centre
- Vodafone shows 3G outdoor coverage of the centre.

In summary, there appears to be good coverage of the centre from the three mobile network operators.

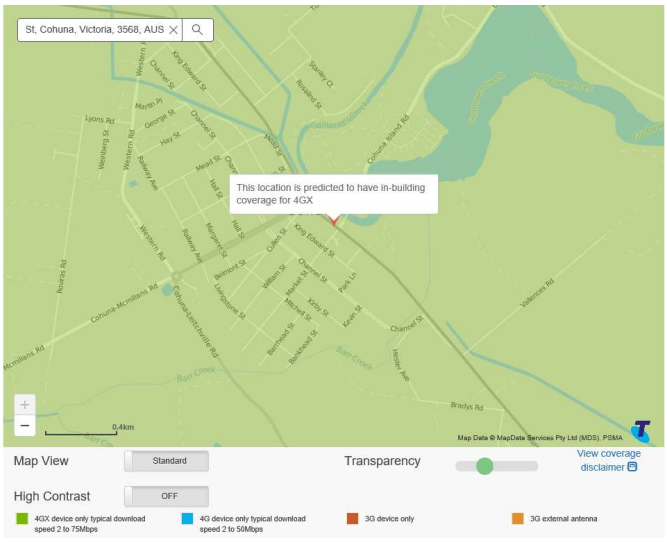

Figure 77 Telstra mobile coverage of the centre

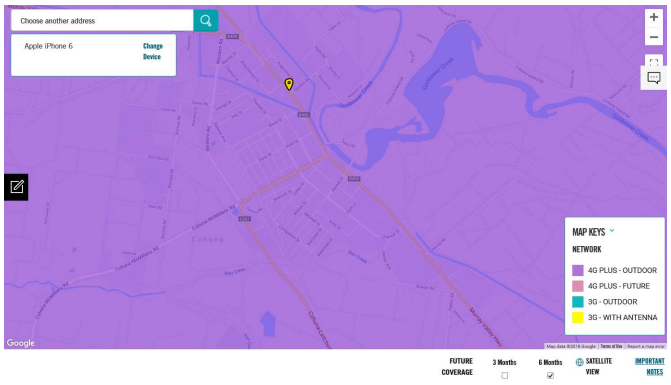

Figure 78 Optus mobile coverage of the centre

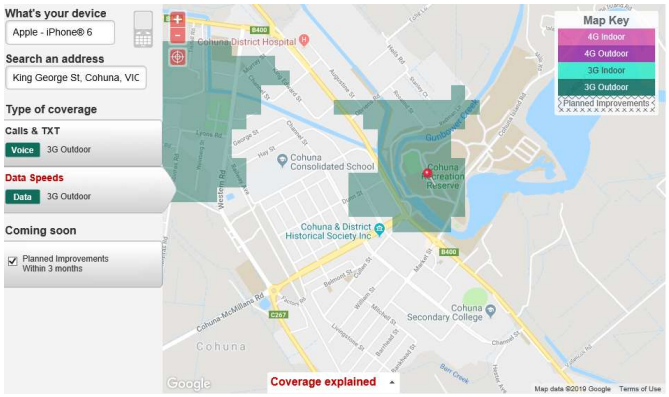

Figure 79 Vodafone mobile coverage of the centre

5.5 Kerang Lakes

Kerang Lakes includes many lakes between Kerang and Lake Boga.

Lake Charm and Kangaroo Lake are particularly popular with visitors for water activities such as swimming and water sports. Boat ramps are located at each lake.

Lake Charm hosts the Victorian Ski Racing competition on a regular basis and the Redfin Fishing Classic. Two modern caravan parks are available on the foreshore.

Kangaroo Lake is famously known as the birthplace of former Australian Prime Minister, Sir John Gorton. A caravan park is located on the foreshore. The west side border of the lake is lined with residences and the Brown Brothers vineyard.

Figure 80 Aerial imagery of Kangaroo Lake and Lake Charm

Figure 81 Ski Racing at Lake Charm[19]

Fixed Broadband

Our analysis reveals both lakes and the surrounding area fall into the NBN satellite footprint.

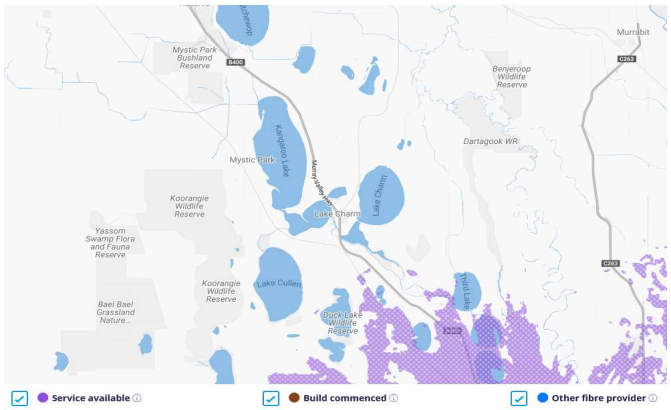

Figure 82 NBN Coverage of Kangaroo Lake and Lake Charm (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the two lakes
- Optus shows predominately 4G Plus outdoor coverage of the lakes with patches of 3G outdoor coverage on the outskirts of the lakes
- Vodafone shows limited 4G outdoor and 3G outdoor coverage of each lake.

In summary, there appears to be good coverage of the lakes from two of the three mobile network operators.

Figure 83 Telstra mobile coverage of Kangaroo Lake and Lake Charm

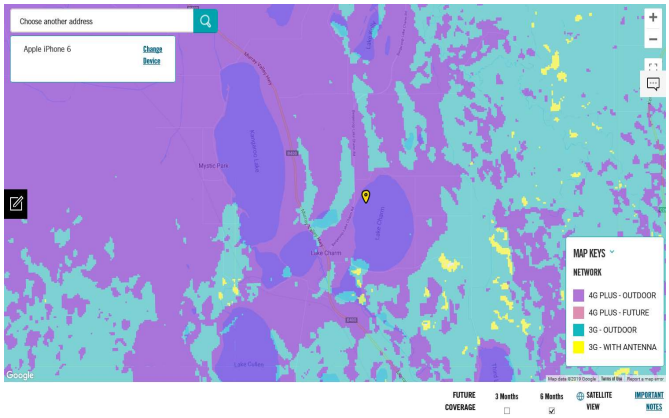

Figure 84 Optus mobile coverage of Kangaroo Lake and Lake Charm

[19] https://www.visitkerangcohunakoondrook.com.au/great-outdoors/lakes

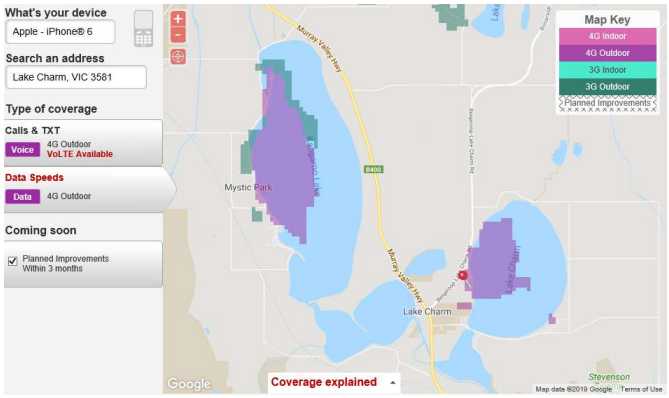

Figure 85 Vodafone mobile coverage of Kangaroo Lake and Lake Charm

5.6 Gunbower Island

Gunbower Island is Australia's largest inland island located between the Murray River and Gunbower Creek.

The internationally recognised wetlands houses several species of birdlife, amphibians and native mammals. There are several campgrounds on the island located on the banks of the Murray River offering the opportunity to participate in activities such as swimming, fishing and boating.

Figure 86 Aerial imagery of Gunbower Island

Figure 87 Wetlands in Gunbower Island[20]

Fixed Broadband

Our analysis reveals Gunbower Island falls into the NBN satellite footprint.

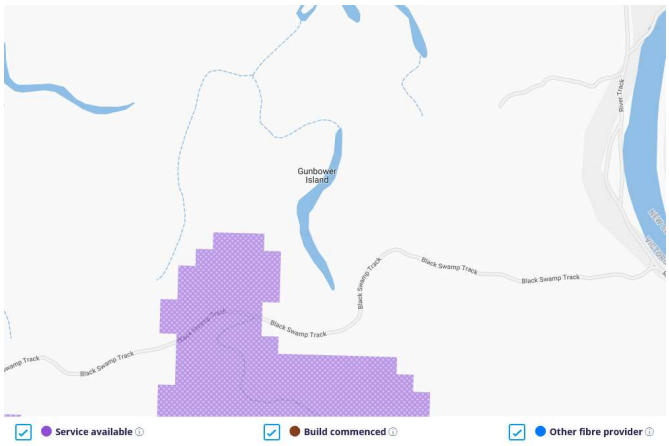

Figure 88 NBN Coverage of Gunbower Island (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) and 3G device coverage of the island
- Optus shows 4G Plus outdoor and 3G outdoor coverage of the island
- Vodafone shows no coverage of the island.

In summary, there appears to be good coverage of the island from two of the three mobile network operators.

[20] http://www.australiancampsites.com.au/index.php/gunbower-island-vic

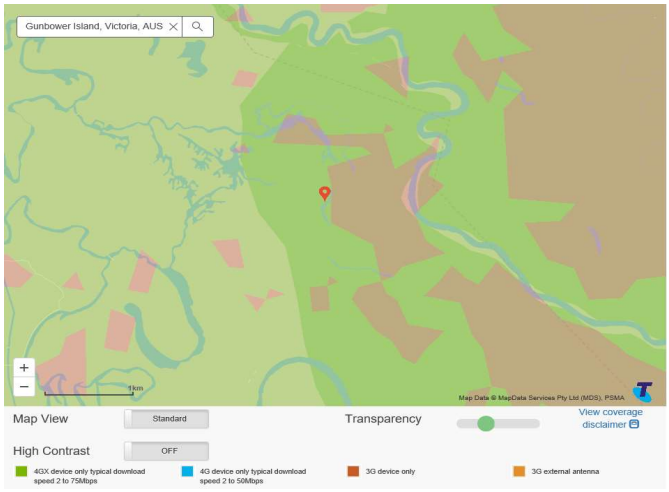

Figure 89 Telstra mobile coverage of Gunbower Island

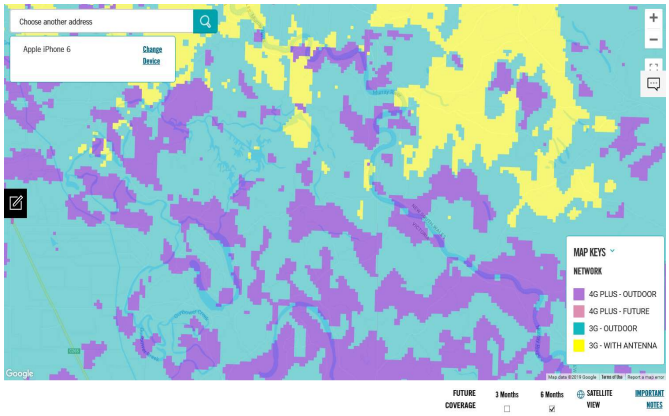

Figure 90 Optus mobile coverage of Gunbower Island

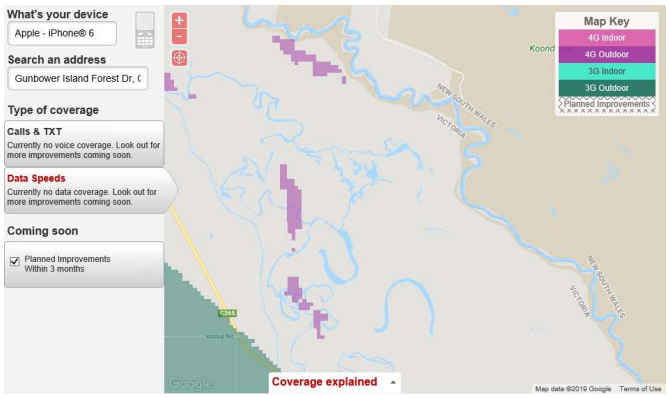

Figure 91 Vodafone mobile coverage of Gunbower Island

5.7 Nyah Vinifera State Forest

The Nyah Vinifera State Forest is located near Swan Hill covering an area of approximately 1000 hectares. The forest houses century old red gums, billabongs and lagoons along the Murray River.

Free campsites are available along the Murray River however, facilities are not provided. The forest can be explored by foot where several species of wildlife can be seen as well as Aboriginal historical sites.

Figure 92 Aerial imagery of Nyah Vinifera State Forest

Figure 93 The wetlands in Nyah Vinifera State Forest[21]

Fixed Broadband

Our analysis reveals the Nyah Vinifera State Forest falls into the NBN satellite footprint.

[21] https://www.campsight.com.au/catalogue/north-west-victoria/vinifera-camping--nyah-vinifera-park---north-of-swan-hill

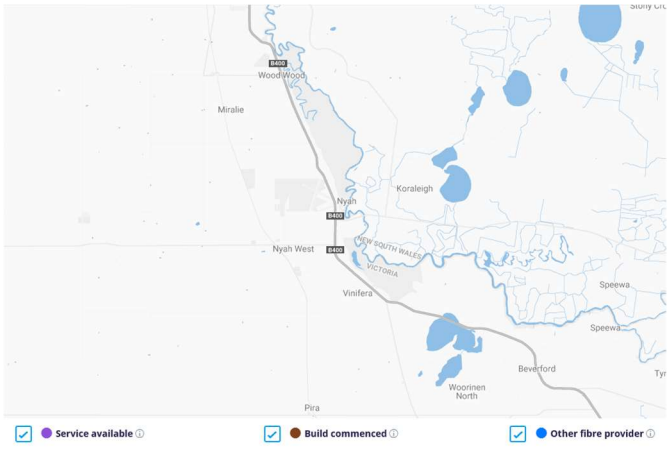

Figure 94 NBN Coverage of Nyah Vinifera State Forest (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the forest and along the Murray River
- Optus shows predominately 4G Plus outdoor coverage of the forest and the Murray River with patches of 3G outdoor coverage further north
- Vodafone shows predominately 4G indoor coverage of the forest with 4G outdoor further north along the Murray River.

In summary, there appears to be good coverage of the forest and along the Murray River from all three mobile network operators.

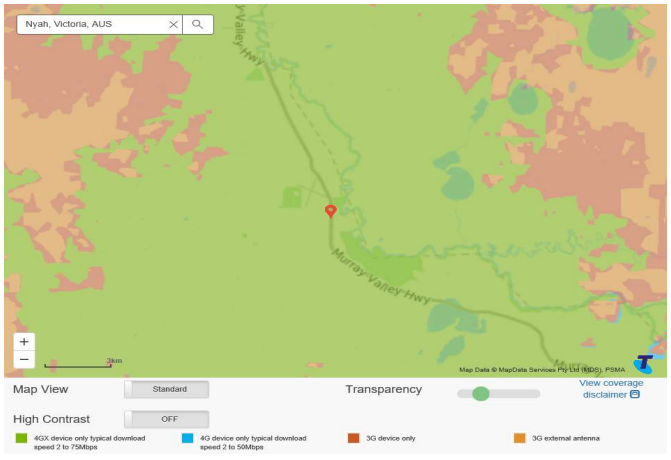

Figure 95 Telstra mobile coverage of Nyah Vinifera State Forest

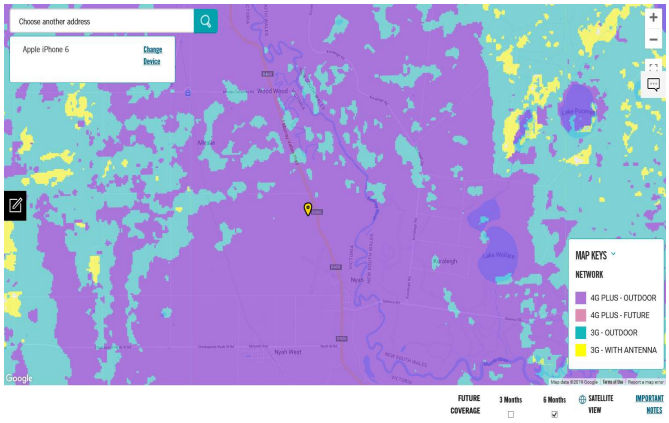

Figure 96 Optus mobile coverage of Nyah Vinifera State Forest

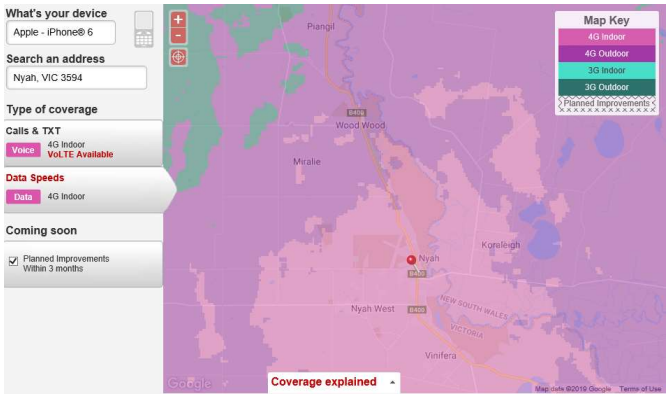

Figure 97 Vodafone mobile coverage of Nyah Vinifera State Forest

5.8 Hattah Kulkyne National Park

Hattah Kulkyne National Park is approximately 48,000 hectares in size, 74 kilometres south of Mildura.

The extensive low scrub and open native pine woodland are characteristics of the park with various wildlife calling the park home. The range of activities that can be undertaken include canoeing, fishing, driving, bicycle riding and walking.

A visitor centre operates in the park that provides information on the park including the Park's history and cultural heritage. Two unpowered campgrounds with non-flush toilets, fireplaces and picnic tables are located at Lake Hattah and Lake Mournpall and are available to book.

Figure 98 Aerial imagery of Hattah Kulkyne National Park

Figure 99 Hattah Kulkyne National Park[22]

Fixed Broadband

Our analysis reveals the visitor centre falls into the NBN satellite footprint.

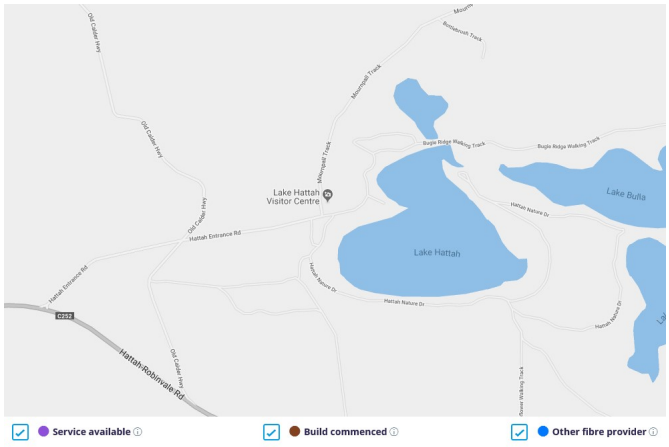

Figure 100 NBN Coverage of the visitor centre (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the campgrounds and visitor centre
- Optus shows 4G Plus outdoor and 3G outdoor coverage of the visitor centre, 4G Plus coverage of Lake Hattah campground and 3G outdoor coverage of Lake Mournpall campground
- Vodafone shows no coverage of the campgrounds or visitor centre.

In summary, there appears to be good coverage of the campgrounds and visitor centre from two of the three mobile network operators.

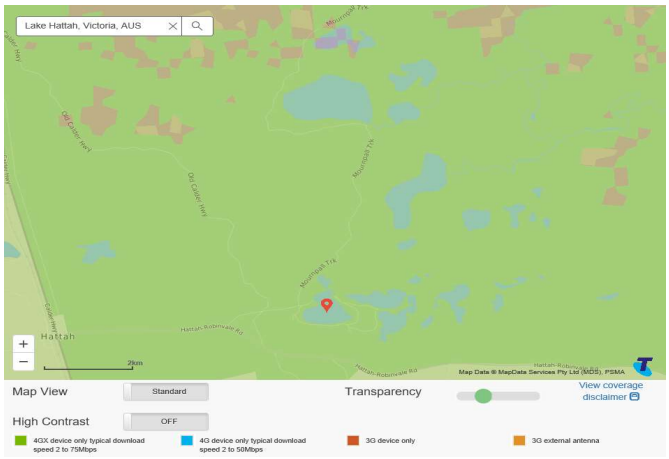

Figure 101 Telstra mobile coverage of the campgrounds and visitor centre

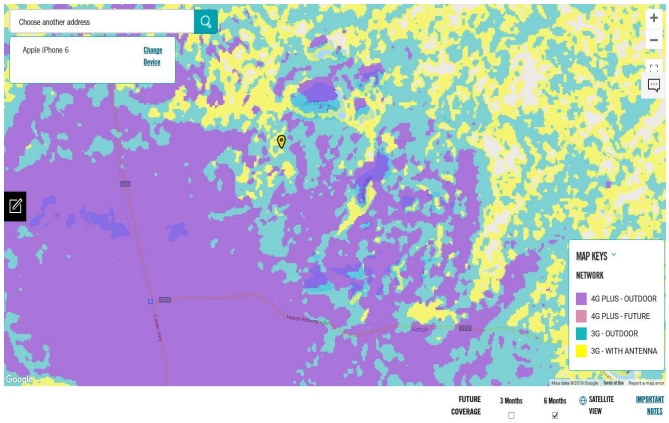

Figure 102 Optus mobile coverage of the campgrounds and visitor centre

[22] https://www.visitmelbourne.com/regions/the-murray/things-to-do/nature-and-wildlife/national-parks-and-reserves/hattah-kulkyne-national-park

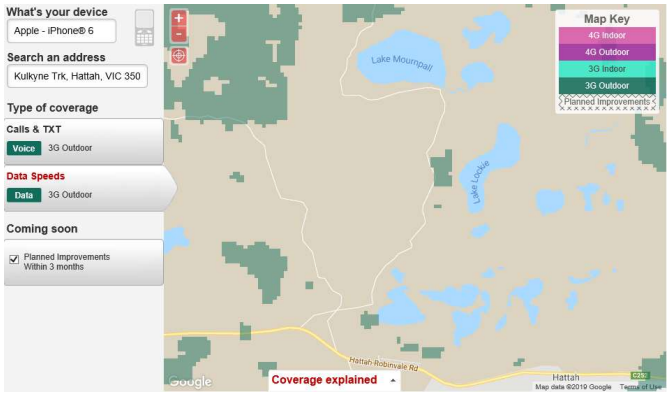

Figure 103 Vodafone mobile coverage of the campgrounds and visitor centre

5.9 Esoteric Festival

Esoteric Festival is an annual music and arts festival held near Donald on the Labour Day Weekend.

Figure 104 Festival goers at Esoteric Festival [23]

A map of the festival venue near Donald is shown below.

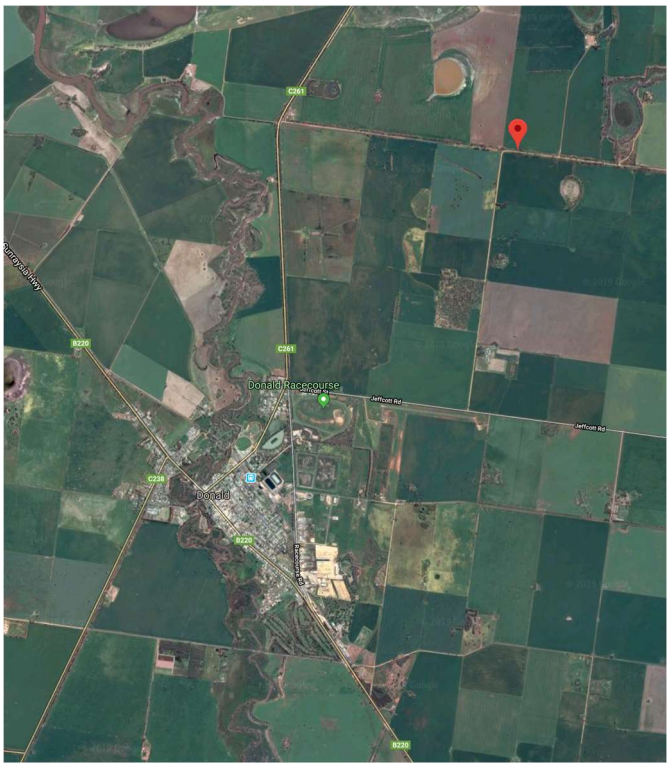

Figure 105 Aerial imagery of festival venue at Gil Gil Road Donald

Fixed Broadband

Our analysis reveals the festival venue falls into the NBN fixed wireless footprint.

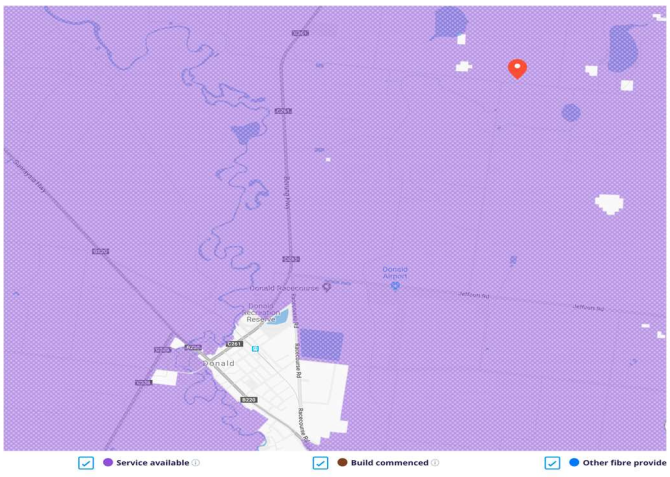

Figure 106 NBN Coverage of festival venue at Gil Gil Road Donald (NBN Co)

[23] https://esotericfestival.com.au/info/

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the venue
- Optus shows 4G Plus outdoor coverage of the venue
- Vodafone shows no coverage at all.

In summary, there appears to be good coverage of the venue from two of the three mobile network operators.

Figure 107 Telstra mobile coverage of festival venue

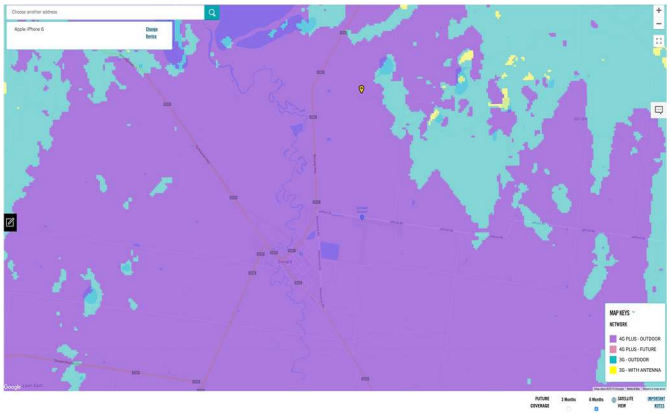

Figure 108 Optus mobile coverage of festival venue

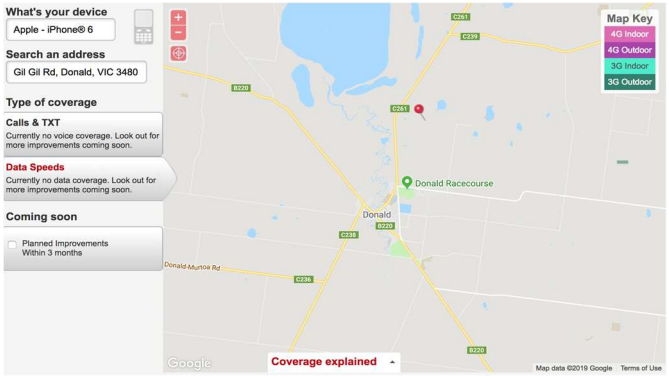

Figure 109 Vodafone mobile coverage of festival venue

5.10 Big Cohuna Festival

The Big Cohuna Festival is a five-day event held over the Melbourne Cup long week and includes a street food festival, art displays, live music, fairs, farmers and makers markets. The festival is held at the Cohuna Garden Park.

Figure 110 Venue for The Big Cohuna Festival

Fixed Broadband

Our analysis reveals the festival venue falls into the NBN fixed line footprint.

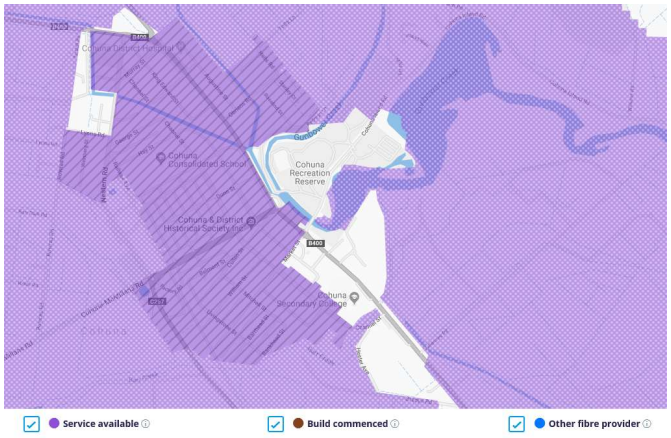

Figure 111 NBN Coverage of festival venue at Cohuna (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the venue
- Optus shows 4G Plus outdoor coverage of the venue
- Vodafone shows no coverage at all.

In summary, there appears to be good coverage of the venue from two of the three mobile network operators.

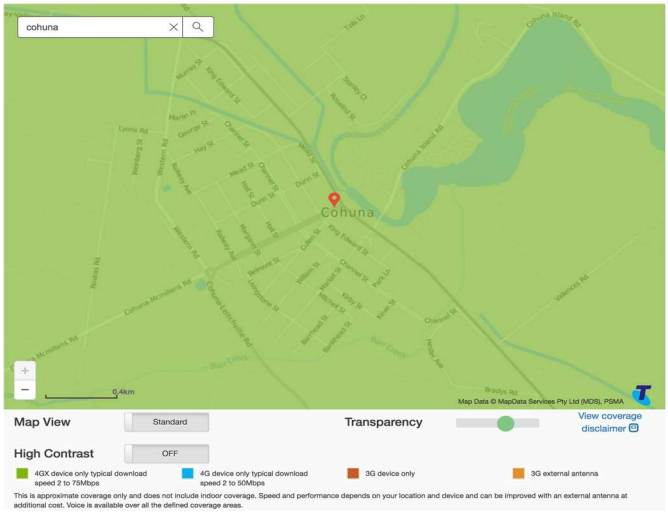

Figure 112 Telstra mobile coverage of Cohuna and the festival venue

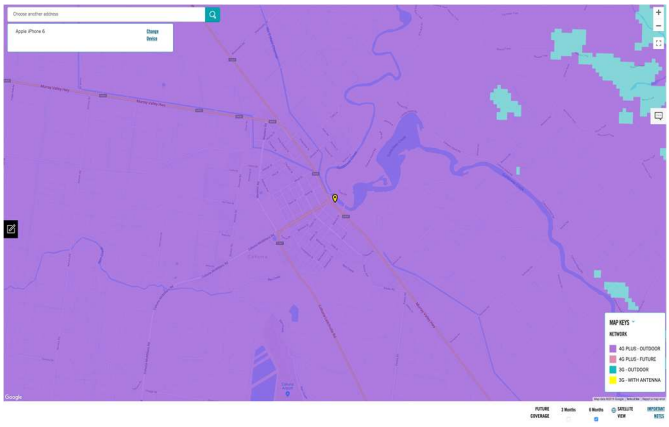

Figure 113 Optus mobile coverage of Cohuna and the festival venue

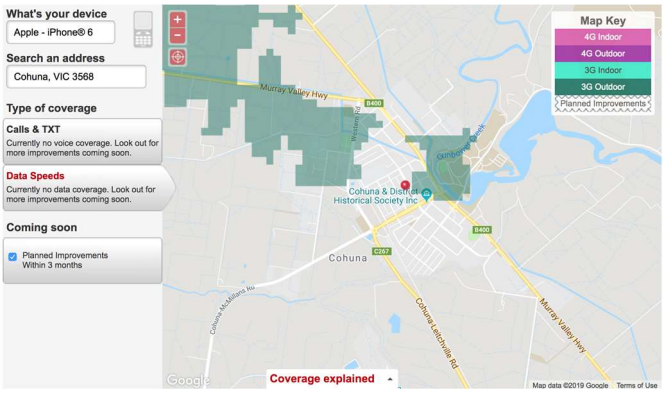

Figure 114 Vodafone mobile coverage of Cohuna and the festival venue

5.11 Cullulleraine Music Festival

The Cullulleraine Music Festival is held in April at the Johansen Memorial Reserve, incorporating the Lake Cullulleraine Holiday Park and RSL camp around 40 minutes' drive west of Mildura on the edge of the unique Lake Cullulleraine.

Cullulleraine Music Festival attracts local, national, and internationally acclaimed artists to the region to provide a range of entertainment and engagement across the three-day camping event.

The Festival provides a fun and friendly atmosphere showcasing the local region. A range of market stalls, children's activities, and a selection of food stalls will be provided along with great music from many genres.

Figure 115 Venue for Cullulleraine Music Festival at Lake Cullulleraine

Fixed Broadband

Our analysis reveals the festival venue falls within the NBN satellite footprint.

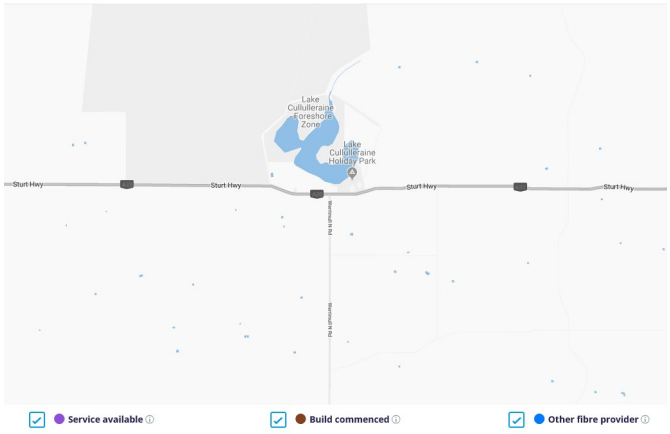

Figure 116 NBN Coverage of festival venue at Lake Cullulleraine (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 3G outdoor handheld device coverage at the lake and the venue
- Optus shows strong 4G Plus outdoor coverage at the lake and the venue
- Vodafone shows strong 4G indoor coverage at the lake venue.

In summary, there appears to be good coverage of the venue from the three mobile network operators.

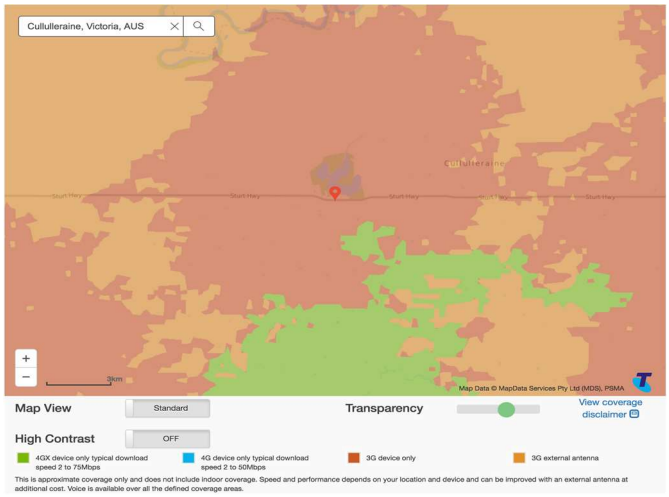

Figure 117 Telstra mobile coverage of Lake Cullulleraine and the festival venue

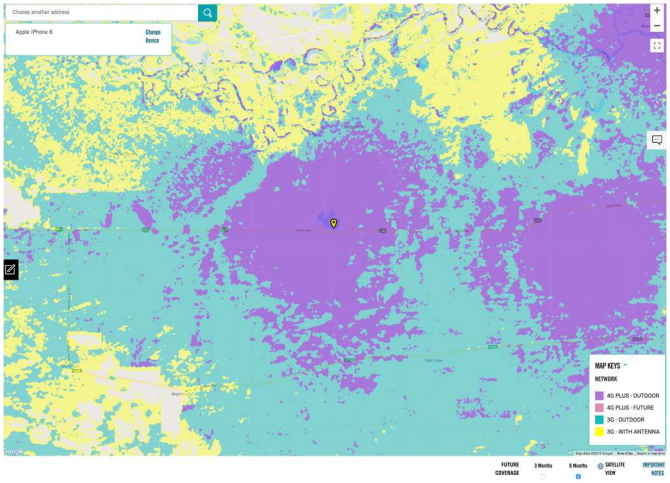

Figure 118 Optus mobile coverage of Lake Cullulleraine and the festival venue

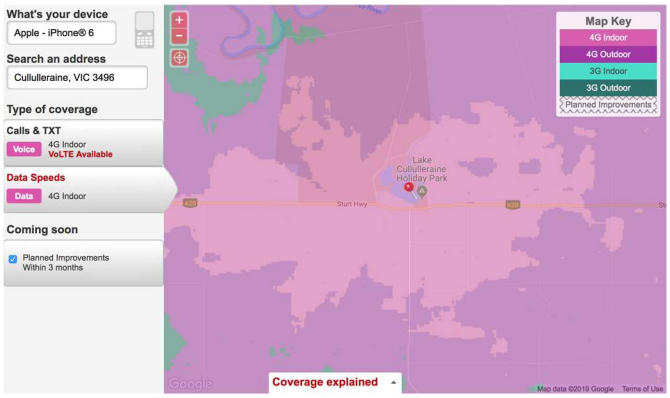

Figure 119 Vodafone mobile coverage of Lake Cullulleraine and the festival venue

5.12 Silo Art Trail

The Silo Art Trail is a 200 kilometre journey that showcases large-scale mural portraits created by local and international street artists on the various grain silos across the Mallee and Wimmera Southern Mallee regions located in Patchewollock, Lascelles, Rosebery, Brim, Sheep Hills and Rupanyup.

Figure 120 Brim Silo Art [24]

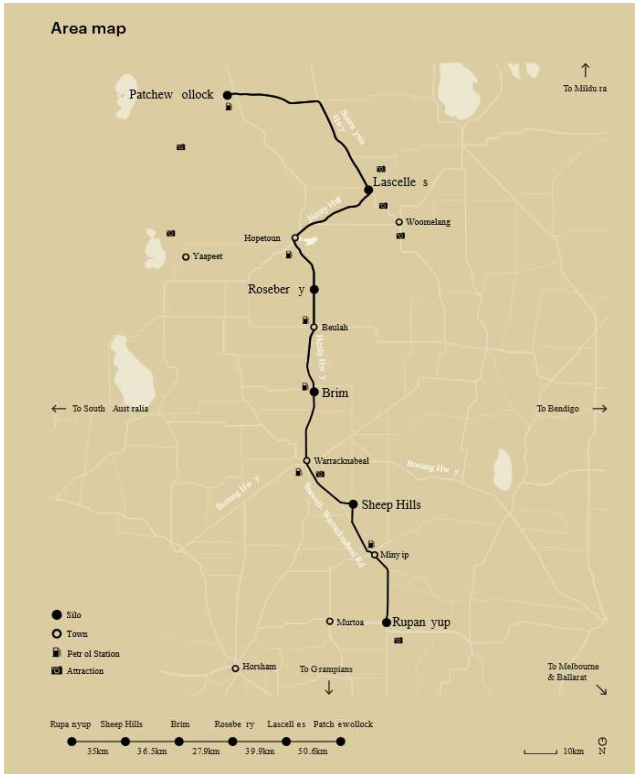

Figure 121 Silo Art Trail Area Map [25]

Fixed Broadband

Our analysis reveals that NBN satellite and NBN fixed wireless service the towns on the Silo Art Trail from Rupanyup to Patchewollock.

Further analysis reveals NBN fixed wireless provides coverage for the towns located in the south which includes Rupanyup, Minyip, Sheep Hills, Brim and Hopetoun (located further north). The towns of Rosebery, Lascelles and Patchewollock are serviced by NBN satellite.

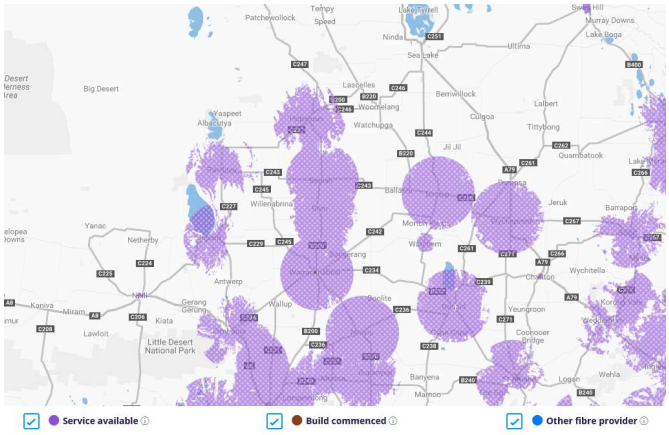

Figure 122 NBN Coverage of the Silo Art Trail (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) in all of the towns except for Rosebery which has 3G device and 3G external antenna coverage. The Sunraysia, Hopetoun-Walpeup and Henty Highways have patchy 4GX outdoor handheld device with 3G device and 3G external antenna coverage where 4GX is absent down to Rosebery. The remaining route to Rupanyup has 4GX outdoor handheld device coverage
- Optus shows 4G Plus outdoor, 3G outdoor and 3G with antenna coverage in all the towns but patchy 4G coverage along the route between towns.
- Vodafone shows no mobile coverage of the area.

In summary, visitors have options for good coverage at the key towns along the route from two of the three

[24] https://www.visitmelbourne.com/regions/grampians/things-to-do/art-theatre-and-culture/public-art/brim-silo

[25] http://siloarttrail.com/home/#area-map

mobile network operators, however there is patchy 4G coverage along the transport corridors on the trail.

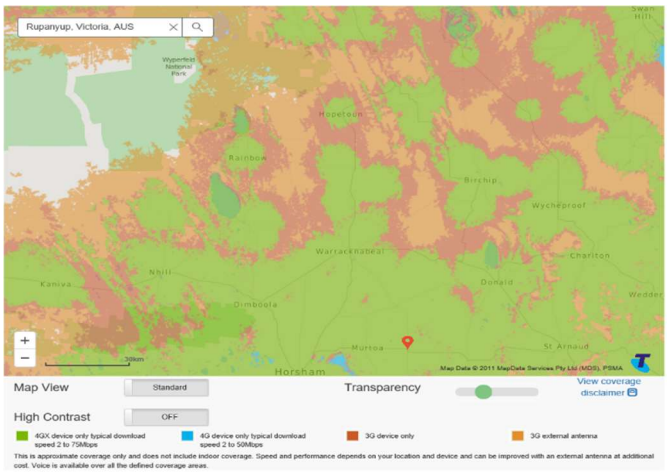

Figure 123 Telstra mobile coverage of the Silo Art Trail

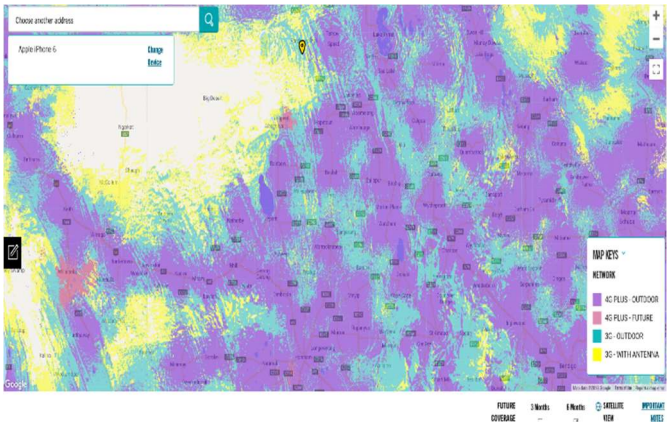

Figure 124 Optus mobile coverage of the Silo Art Trail

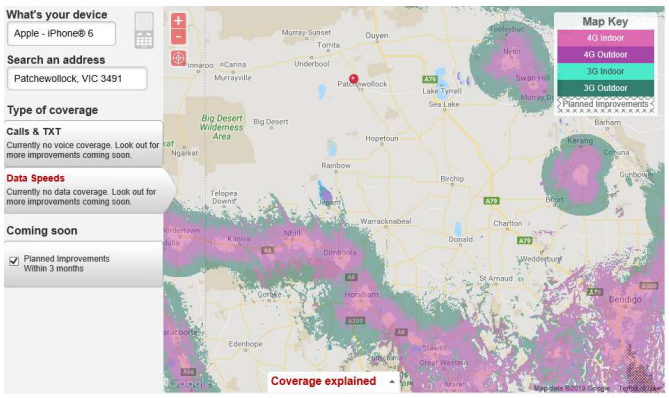

Figure 125 Vodafone mobile coverage of the Silo Art Trail

6 Transport Corridors

6.1 Introduction

For the purposes of transport, only cellular network coverage is considered in this report. fixed broadband is, by its nature, inapplicable to mobile users. IoT applications utilising LP-WAN technologies may emerge in the future but are not "on the radar" at this stage.

In terms of meeting the needs of mobile users, this report considers both road and rail. In the case of rail services, mobile reception depends not only on the availability of coverage along the route, but also on the design of carriages (which can block signals) and the provision of any internal repeaters (to boost internal reception). Since the carriages serving a route can vary from day to day, this report can only consider the level of mobile coverage along the route.

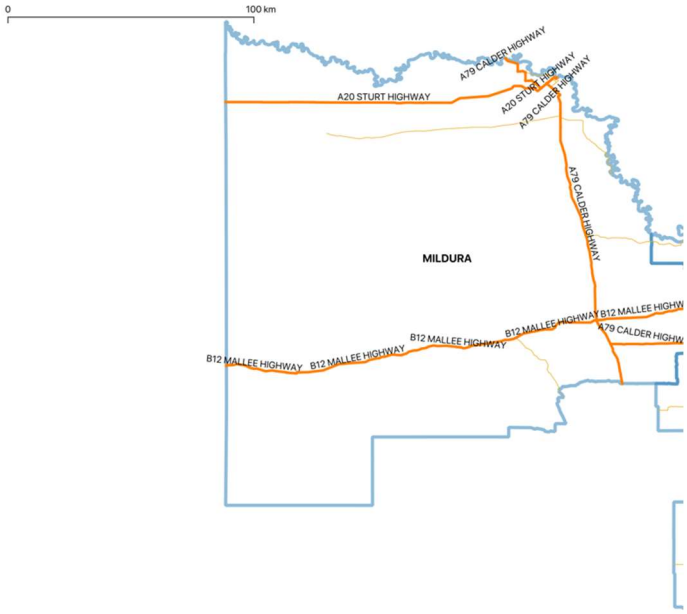

Figure 126 Mallee region declared roads and rail routes

In the case of road transport, the main indicator of demand is the road classification (designated M/A, B or C-grade roads)[26]. It is recognised that there may be other local roads that carry high traffic volumes or that have a poor accident history and where there is poor coverage. Local knowledge is the most effective means of identifying such locations.

Discussions with the MNOs are underway to explore incorporation of the public coverage information into SLIM. If and when such information becomes available, it will become more practical to identify and characterise transport mobile blackspots more easily and efficiently.

Fieldwork commencing at the time of preparation of this report may also yield more accurate insights into significant transport mobile blackspots.

6.2 Freeways/Motorways

There are no motorways in the region.

6.3 A/B Grade Roads

There are 7 A and B roads in the region. Those listed in the table below have been reviewed by a visual scan of public carrier maps.

Highway Name	Approx Start	Approx End	Dist (km)
A20 Sturt Highway	Yamba	Mildura	116
A79 Calder Highway	Mildura	Woosang	330
B12 Mallee Highway	Pinnaroo	Tooleybuc	230
B220 Sunraysia Highway 1	Ouyen	Tempy	17

[26] "A" and "B" routes are arterial highways (classification AH). "C" routes typically link smaller population centres to larger regional centres, or roads (classification AO).

B220 Sunraysia Highway 2	Woomelang	Cope Cope	115
B260 Loddon Valley Highway	Kerang	Macorna	22
B400 Murray Valley Highway	Robinvale	Gunbower	244

A20 Sturt Highway (~116 km)

- From near Yamba
- To Mildura

This highway connects Mildura to Adelaide. The section of the highway within the region runs from Mildura to the Victorian border near Yamba in South Australia.

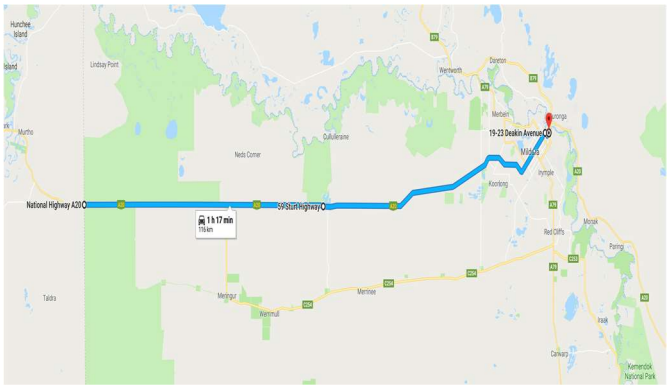

Figure 127 A20 Sturt Highway within the region (Google Maps)

Based on public coverage maps:

- Telstra shows large stretches of 3G handheld and external antenna coverage
- Optus shows continuous 3G and 4G outdoor coverage
- Vodafone shows continuous 4G outdoor coverage or better.

Based on public coverage maps, there appears to be continuous 4G outdoor coverage by two of the three mobile network operators.

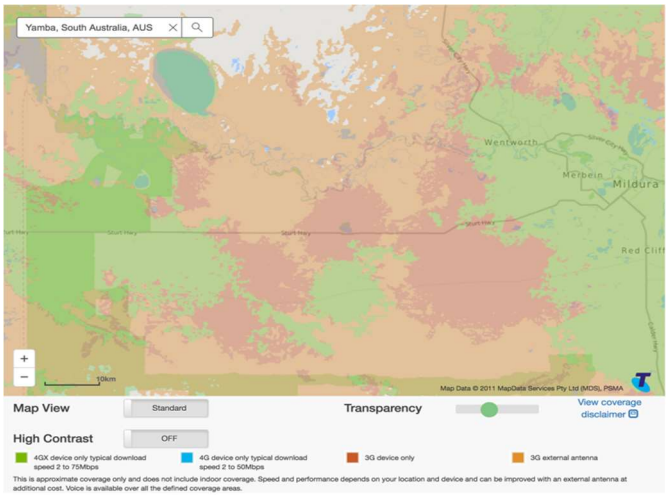

Figure 128 Telstra mobile coverage on the section of A20 Sturt Highway

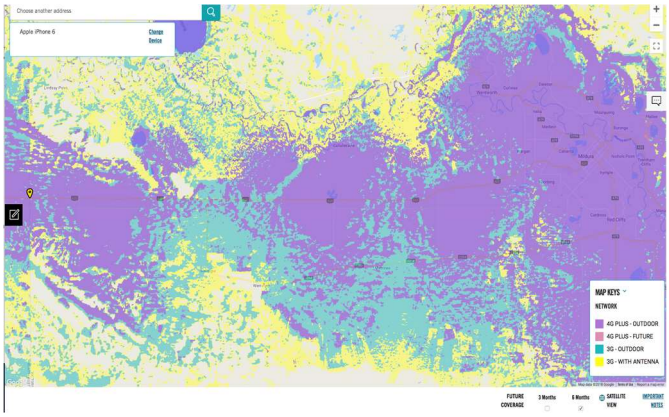

Figure 129 Optus mobile coverage on the section of A20 Sturt Highway

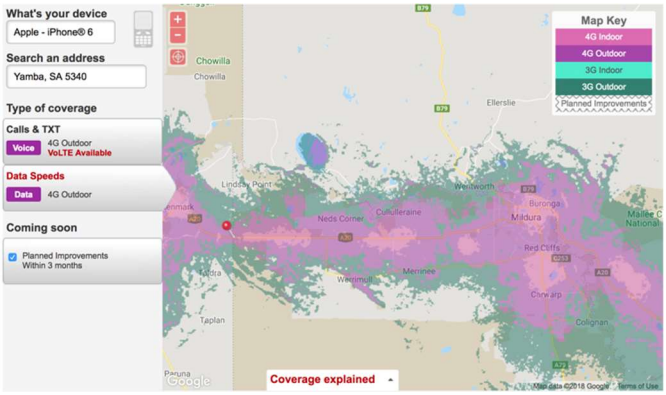

Figure 130 Vodafone mobile coverage on the section of A20 Sturt Highway

A79 Calder Highway (~330 km)

- From Yelta, near Mildura
- To near Woosang

This highway connects Mildura with Bendigo and Melbourne. The section of the highway that falls within the region.

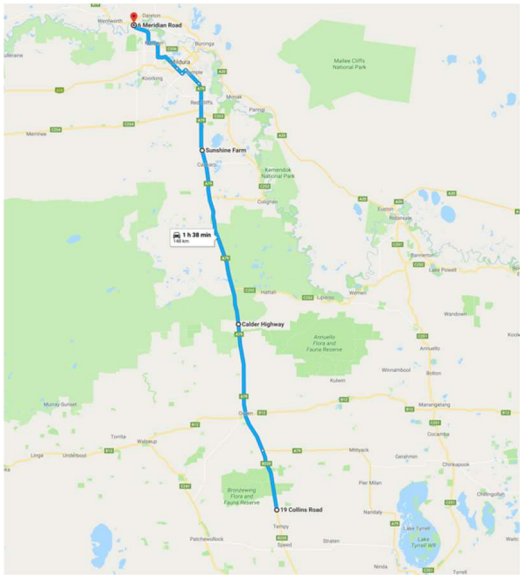

Figure 131 A79 Calder Highway within the region (Google Maps)

Based on public coverage maps:

- Telstra shows continuous 3G and 4GX outdoor coverage, with several areas of 3G external antenna coverage only
- Optus also shows continuous 3G and 4GX outdoor coverage, with several areas of 3G external antenna coverage only
- Vodafone shows no coverage except for near Mildura.

Based on public coverage maps, there appears to be continuous 3G outdoor coverage or better by two of the three mobile network operators.

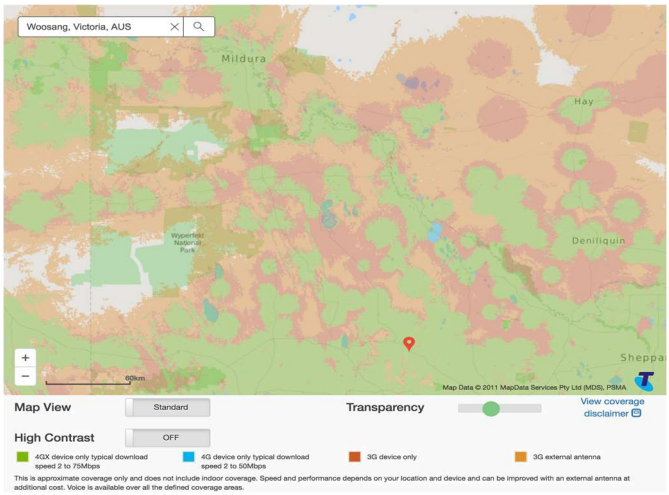

Figure 132 Telstra mobile coverage on A79 Calder Highway

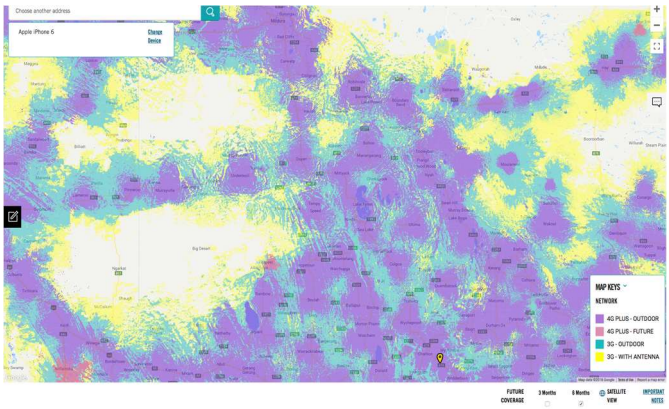

Figure 133 Optus mobile coverage on A79 Calder Highway

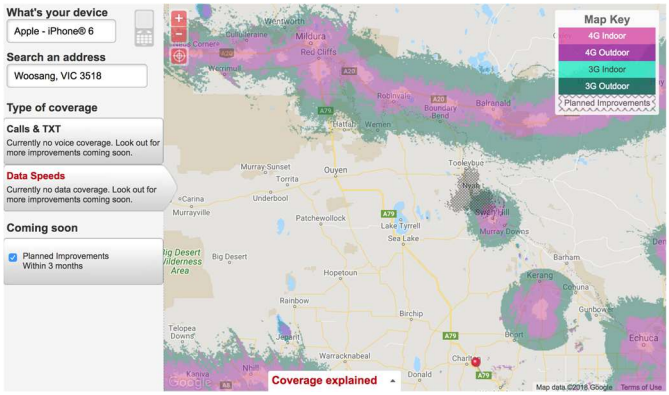

Figure 134 Vodafone mobile coverage on A79 Calder Highway

B12 Mallee Highway (~230 km)

- From Pinnaroo, Vic/SA border
- To Tooleybuc, Vic/NSW border

This highway connects the Princes Highway near Murray Bridge in South Australia to the Murray Valley

Highway on the Victorian / NSW border via Ouyen. The section of highway within the region runs from near Pinnaroo to the end of the highway near Tooleybuc.

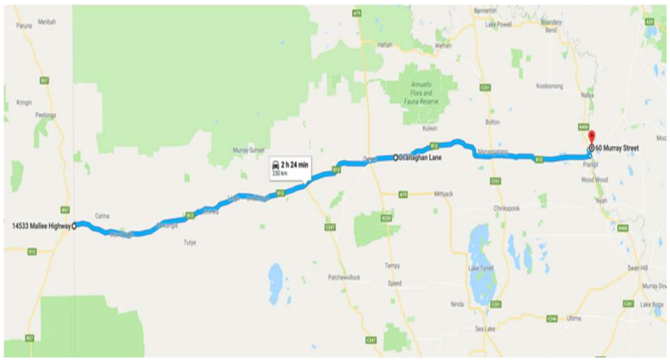

Figure 135 B12 Mallee Highway within the region (Google Maps)

Based on public coverage maps:

- Telstra shows 4GX device only around population centres with significant stretches of 3G handheld and external antenna coverage
- Optus shows continuous 3G and 4G outdoor coverage with patchy 3G external antenna coverage between population centres with some black spots between the communities of Murrayville and Underbool
- Vodafone shows 4G outdoor coverage no coverage at all, but a small area of highway coverage near Nyah under construction.

Based on public coverage maps, there appears to be continuous 3G outdoor handheld coverage or better by two mobile network operators but several localised sections of external antenna coverage and blackspots.

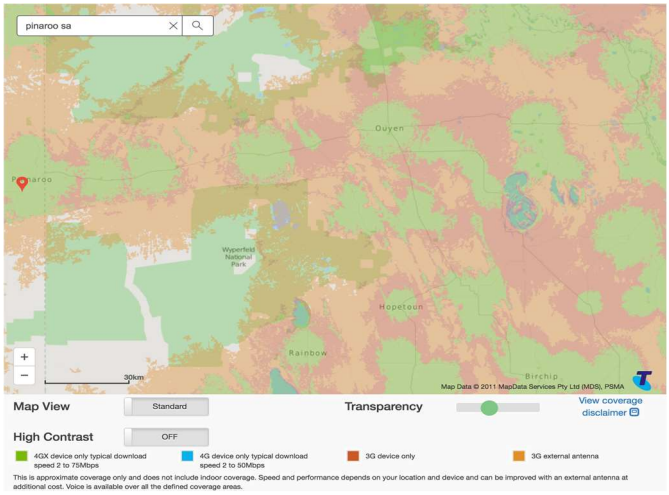

Figure 136 Telstra mobile coverage on B12 Mallee Highway

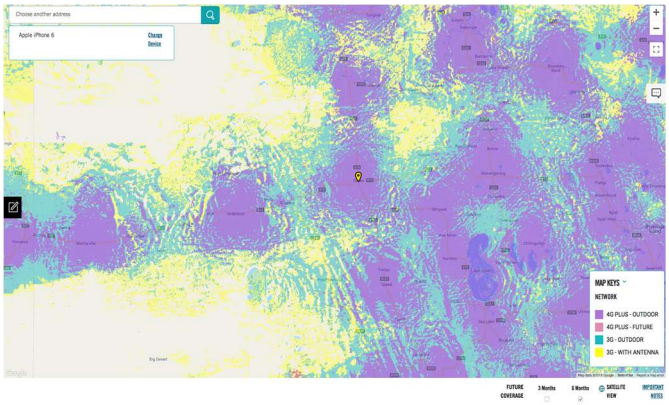

Figure 137 Optus mobile coverage on B12 Mallee Highway

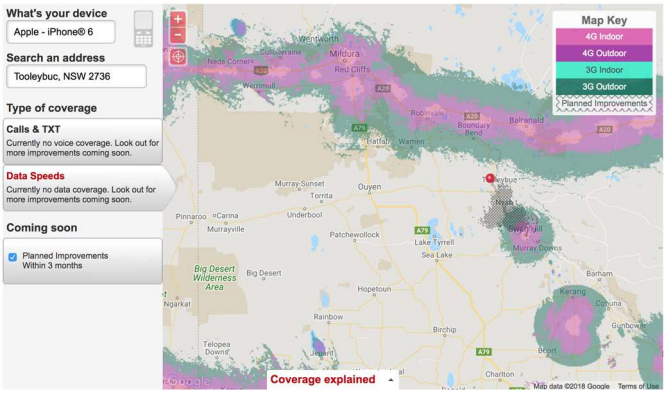

Figure 138 Vodafone mobile coverage on B12 Mallee Highway

B220 Sunraysia Highway 1 (~17 km)

- From near Ouyen
- To Tempy

This highway connects the Calder Highway near Ouyen to the Western Freeway near Ballarat via Birchip, Donald, St Arnaud and Avoca. There are two sections of the Sunraysia Highway that fall within the region boundaries. This section deals with the northernmost section.

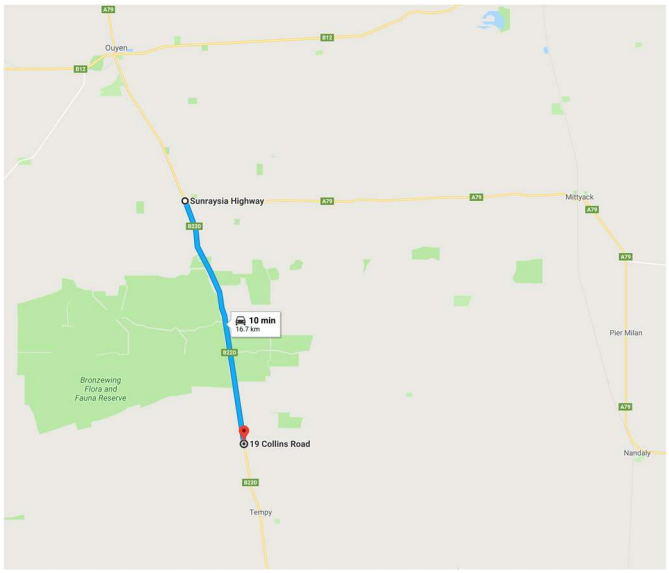

Figure 139 B220 Sunraysia Highway (Google Maps)

Based on public coverage maps:

- Telstra shows continuous 4GX and 3G outdoor coverage over the route
- Optus shows near-continuous 4G and 3G over the route, however coverage appears marginal across significant sections of the route
- Vodafone shows no coverage at all.

Based on public coverage maps, there appears to be continuous coverage across the entire route by one mobile network operator, with partial coverage by a second operator.

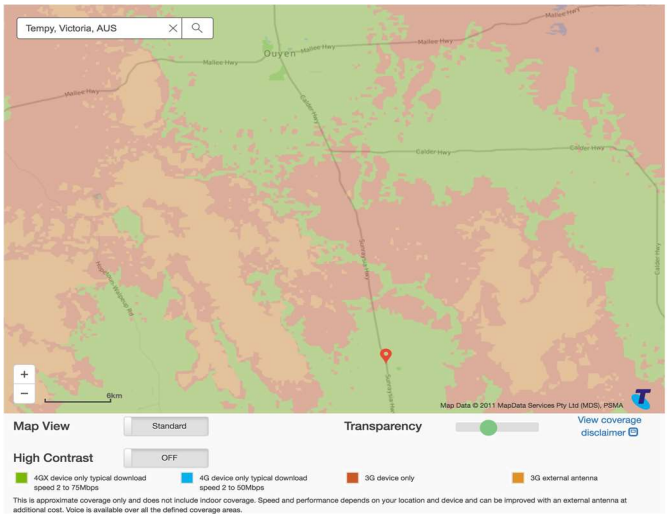

Figure 140 Telstra mobile coverage on B220 Sunraysia Highway

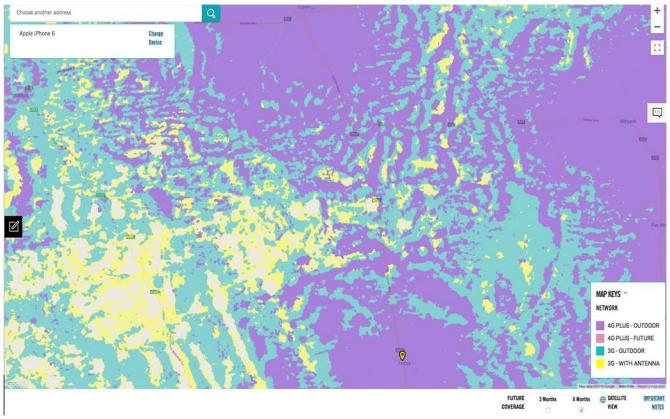

Figure 141 Optus mobile coverage on B220 Sunraysia Highway

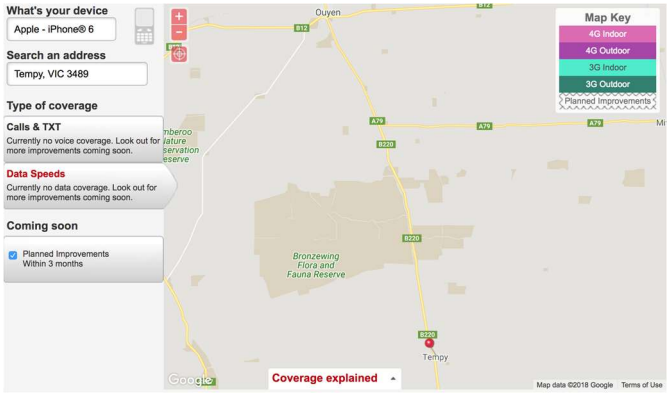

Figure 142 Vodafone mobile coverage on B220 Sunraysia Highway

B220 Sunraysia Highway 2 (~89 km)

- From Woomelang
- To Cope Cope, near St Arnaud

This highway connects the Calder Highway near Ouyen to the Western Freeway near Ballarat via Birchip, Donald, St Arnaud and Avoca. There are two sections of the Sunraysia Highway that fall within the region boundaries. This section deals with the southernmost section.

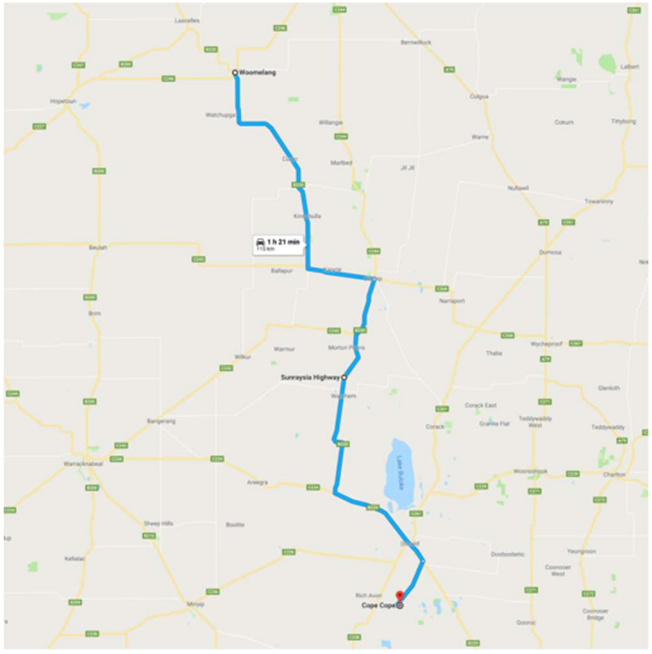

Figure 143 B220 Sunraysia Highway 2 (Google Maps)

Based on public coverage maps:

- Telstra shows continuous 4GX outdoor coverage across the route
- Optus shows continuous 4G outdoor coverage across the route
- Vodafone shows no coverage across the route.

Based on public coverage maps, there appears to be continuous coverage across the entire route by two mobile network operators .

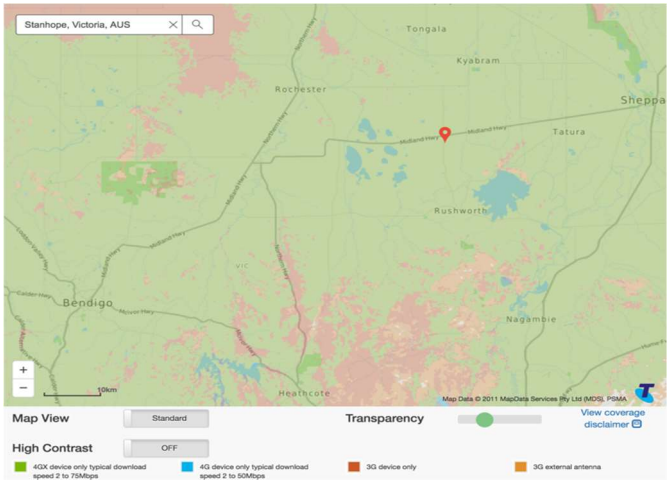

Figure 144 Telstra mobile coverage on section of B220 Sunraysia Highway

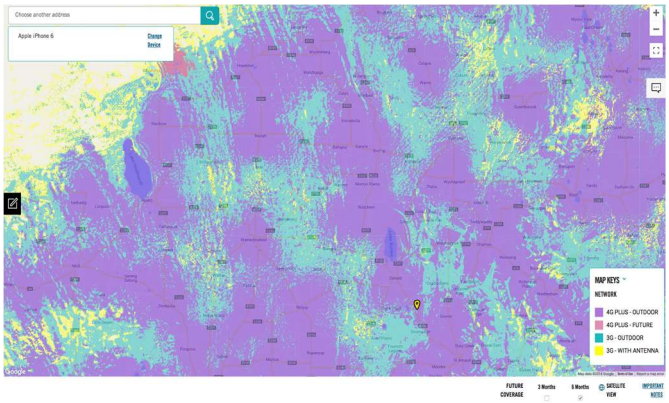

Figure 145 Optus mobile coverage on section of B220 Sunraysia Highway

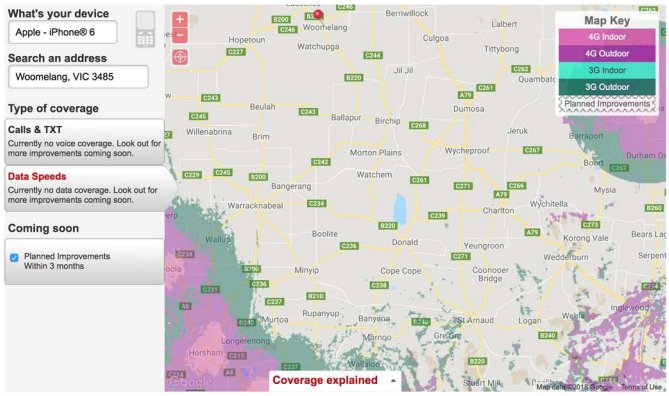

Figure 146 Vodafone mobile coverage on section of B220 Sunraysia Highway

B260 Loddon Valley Highway (~22 km)

- From near Kerang
- To Macorna

This highway connects Kerang to near Bendigo. The section of the highway that falls within the region ends near Macorna.

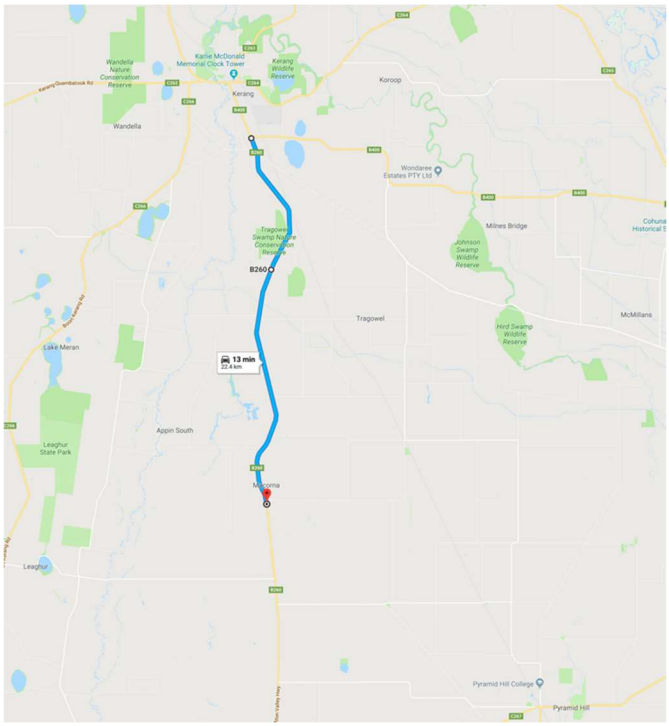

Figure 147 Section of B260 Loddon Valley Highway (Google Maps)

Based on public coverage maps:

- Telstra shows partial 4GX and 3G device outdoor coverage across the route
- Optus shows continuous 4G and 3G outdoor coverage across the route, although coverage appears marginal in some sections
- Vodafone shows continuous 4G outdoor coverage across the route.

Based on public coverage maps, there appears to be continuous coverage across the entire route by three mobile network operators .

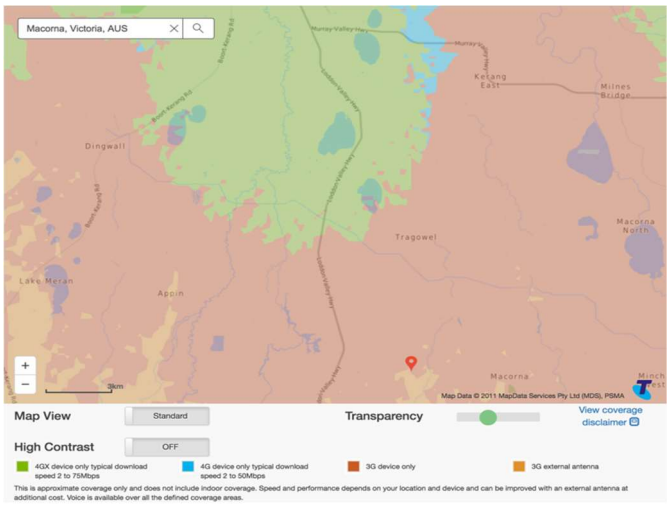

Figure 148 Telstra mobile coverage on B260 Loddon Valley Highway

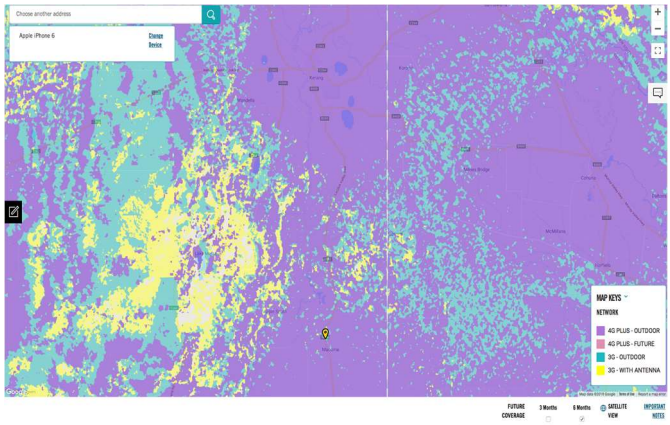

Figure 149 Optus mobile coverage on B260 Loddon Valley Highway

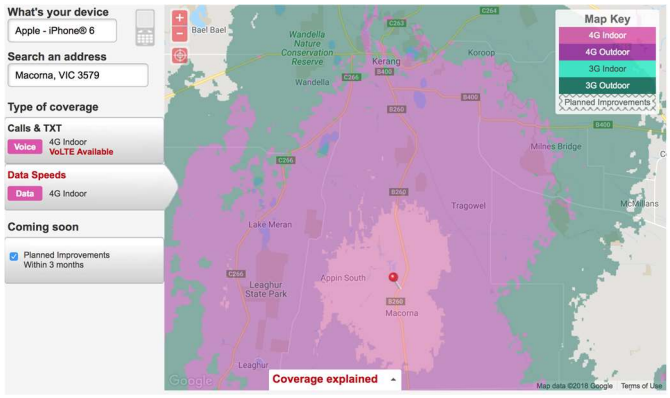

Figure 150 Vodafone mobile coverage on B260 Loddon Valley Highway

B400 Murray Valley Highway (~244 km)

- From Robinvale
- To Gunbower

This highway connects Robinvale to Echuca and beyond, traversing Swan Hill and Kerang. The section of the highway that falls within the region ends near Gunbower.

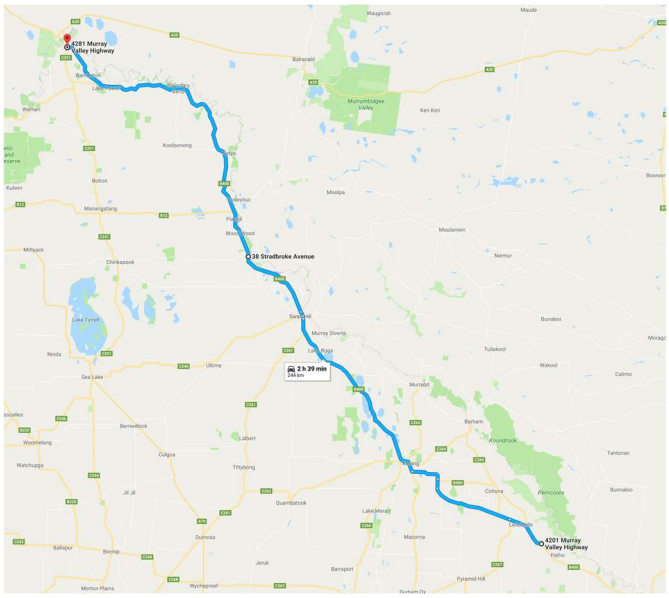

Figure 151 Section of B400 Murray Valley Highway (Google Maps)

Based on public coverage maps:

- Telstra shows continuous 4GX and 3G device outdoor coverage across the route
- Optus shows continuous 4G and 3G outdoor coverage across the route
- Vodafone shows 4G outdoor coverage around the population centres of Robinvale, Swan Hill and Kerang, but no coverage between.

Based on public coverage maps, there appears to be continuous coverage across the entire route by at least two mobile network operators.

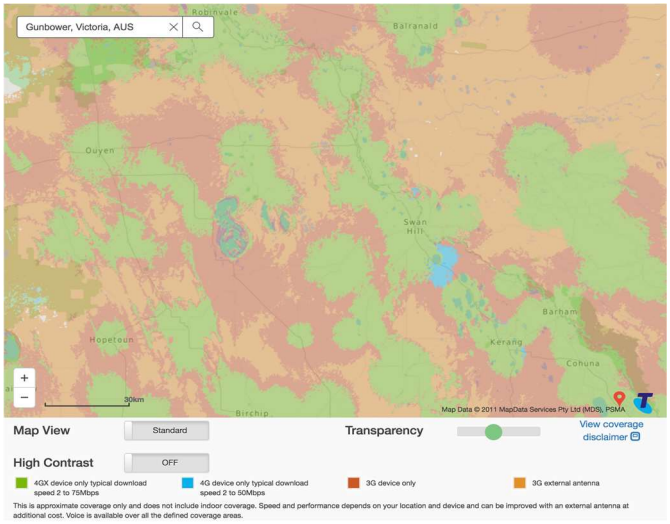

Figure 152 Telstra mobile coverage on B400 Murray Valley Highway

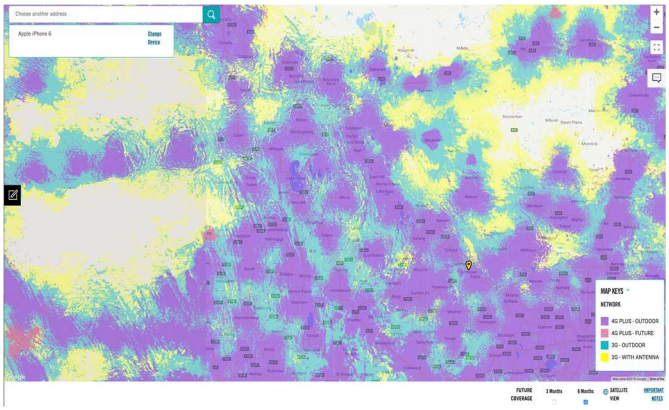

Figure 153 Optus mobile coverage on B400 Murray Valley Highway

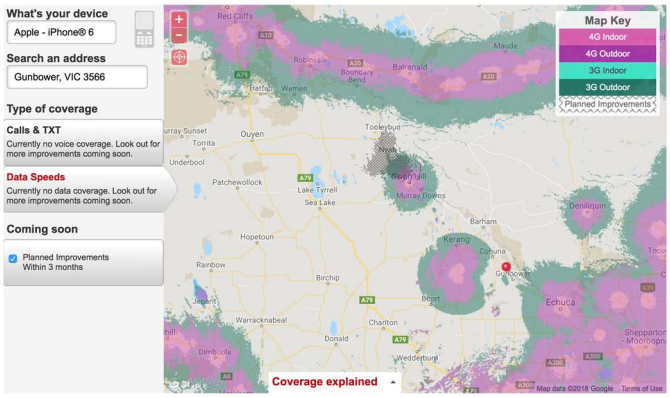

Figure 154 Vodafone mobile coverage on B400 Murray Valley Highway

6.4 C-Grade Roads

There are 37 declared C roads in the region forming a mesh between major and small communities. In general, there is very poor highway coverage across the region, however low population density and large distances presents infrastructure challenges for all mobile carriers. C roads also tend to traverse sparsely populated areas, and this also tends to mean poor quality mobile coverage (either requiring 3G external antenna or fewer mobile carriers providing service).

6.5 Rail

Melbourne – Bendigo

The Victorian Government is undertaking a program to improve mobile services on regional rail routes. This project includes installation of in-train mobile repeaters in all VLocity rail cars as well as improved track-side mobile coverage in certain areas.

As a result of this program, all passengers travelling on the Melbourne-Bendigo route have continuous mobile

coverage from all three MNOs by the end of the 2018 calendar year.

Bendigo – Swan Hill

For passengers travelling on the rail line between Bendigo and Swan Hill, the route carries up to 8 services per weekday. Annual patronage for 2017-18 was 84,000 - a 10% decrease on 2016-17. The section of the rail line failing within the region boundary is from near Mincha West to Swan Hill.

The route is served by VLine diesel-hauled rolling stock and there are no in-train repeaters in the trains. However, these cars also do not suffer from the severe radio frequency shielding as the VLocity rail cars. Consequently, mobile carrier public coverage maps can be used as a guide to in-train mobile coverage.

- Telstra shows continuous 3G and 4GX coverage over the entire route, with coverage quality improving as the rail line begins to run parallel the Murray Valley Highway
- Optus shows continuous 4G and 3G outdoor coverage over the entire route
- Vodafone shows 4G coverage around Swan Hill and Macorna/Kerang communities but no coverage between.

In summary, there appear to be coverage over the route with two of the mobile network operators offering 3G outdoor service or better, noting that localised conditions such as cuttings and overpasses may temporarily disrupt continuous coverage as the train passes through. Further measurement of in-train mobile coverage may be required.

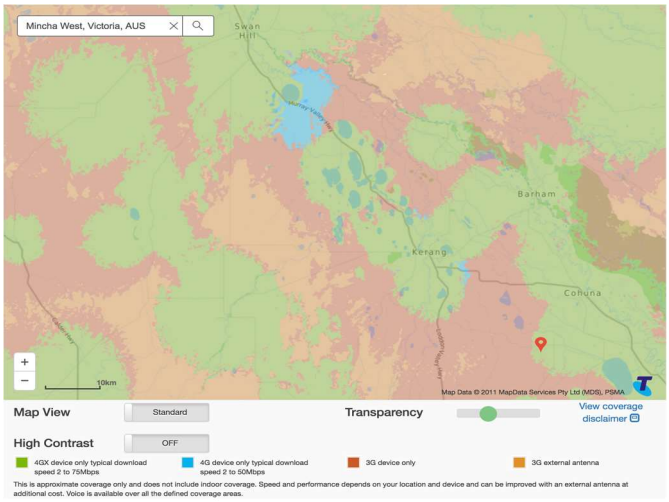

Figure 155 Telstra mobile rail coverage between Mincha West and Swan Hill

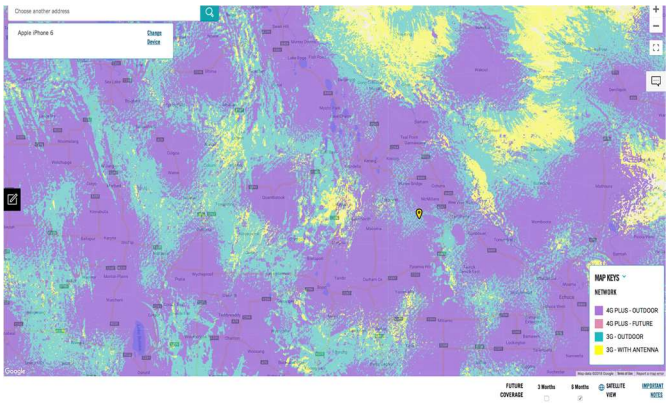

Figure 156 Optus mobile rail coverage between Mincha West and Swan Hill

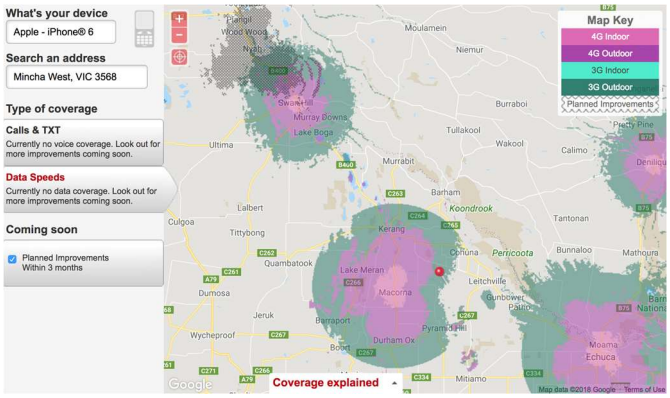

Figure 157 Vodafone mobile rail coverage between Mincha West and Swan Hill

A. Acknowledgements & Qualifications

Acknowledgements

This report includes numerous images and cites many details about locations that have been obtained from a range of sources. Citing a reference for commonly accessed data sources would clutter the document and undermine the flow of relevant information. Accordingly, this section sets out some important acknowledgements regarding data sources.

1. The **Australian Bureau of Statistics** (ABS) provides a rich repository of information at varying levels of aggregation. Two sources in particular have been used extensively over the period from May 2018 to October 2018 during which this report was prepared.

- Data by Region[27] – providing statistics at the level of Local Government Area (LGA).
- Quickstats[28] - providing statistics at varying levels of aggregation, but in particular, at the level of urban centre/locality (UCL) and slightly higher levels of aggregation as appropriate.
- These data are primarily drawn from the June 2016 Population Census.

2. Screen images generated by the **State Level Information Management** (SLIM) **Graphical Information System** (GIS) are compiled from various sources, and typically include an acknowledgement of the relevant sources in the bottom right corner of the image. Such acknowledgements have often been clipped from the images presented in this report, but are acknowledged (based on the type of background) as follows:

- For grey street map backgrounds: "Leaflet | © OpenStreetMap"
- For coloured street map backgrounds: "Leaflet | Tiles © Esri – Source: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012"
- For satellite imagery backgrounds: "Leaflet | Tiles © Esri – Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community"
- For plain grey background: "Leaflet | Tiles © Esri – Esri, DeLorme, NAVTEQ"
- For topographic backgrounds, "Leaflet | Tiles © Esri – Source: Esri, De Lorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, Geobase, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esi China (Hong Kong), and the GIS User Community"

3. For any screen capture of **Telstra**'s public coverage map that does not show an acknowledgement of the data sources, the following acknowledgement applies: "Map Data © 2011 MapData Services Pty Ltd (MDS), PSMA".

4. For any screen capture of **Optus**'s public coverage that does not show an acknowledgement of the data sources, the following acknowledgement applies: "Map data ©2018 Google".

5. For any screen capture of **Vodafone**'s public coverage that does not show an acknowledgement of the data sources, the following acknowledgement applies: "Map data ©2018 GBRMPA, Google".

6. For any screen capture of **Sigfox** coverage that does not show an acknowledgement of the data source, the following acknowledgement applies: "Leaflet".

7. Region-level Digital Inclusion Index data has been purchased from Roy Morgan.

Qualifications

1. The ABS periodically makes corrections to its data (including the 2016 Census data utilised widely in this report), so minor discrepancies may be noted

[27] See http://stat.abs.gov.au/itt/r.jsp?databyregion

[28] See for example http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/UCL211002?opendocument

between figures cited in this report and data obtained from the ABS website.

2. Coverage by different network technologies reflects the situation at a point in time. Network operators regularly expand and reconfigure the networks with resulting changes to coverage. Before placing reliance on any information presented in this report, it is prudent to obtain the latest available information.
3. Mobile reception depends on many factors including the type of device, whether the device has an external antenna and the like. Both the Optus and Vodafone public coverage maps require nominating a device. For consistency, the coverage maps shown are based on a "middle of the range" iPhone6.
4. A fourth Mobile Network Operator (MNO) – TPG – is in the process of entering the Australian market. Its coverage intentions are not currently known.

B. Fieldwork

Two streams of fieldwork tap into the practical experience of the four local governments in Mallee and gather information for the business case feasibility analysis of the top priority project:

- A detailed online survey of local governments
- Face-to-face onsite interviews by expert market research field staff
- Analysis of existing studies provided by respondents.

Results from the fieldwork will be provided to the Regional Partnership when available.

Online survey of local governments

The survey was sent the senior economic development officer (or equivalent) in each local government in August 2018. It sought local government information and views on:

- The importance in their LGA of common unmet digital needs including digitals skills, mobile coverage, NBN service quality, public WiFi, Internet-of-things knowledge and uptake, and access to government infrastructure
- The locations and industries in which these unmet needs impact most severely
- Digital proficiency training needs and more IT professionals
- The location of residential and business developments, and tourist sites, in their LGA
- Details on any digital hubs in their LGA
- The relative importance of the priority digital projects identified by the Regional Partnership and the Digital Plan Working Group

Onsite interviews

Onsite interviews are used to gather detailed information required for the priority project business case analysis. The online survey also requested reports relevant to the survey topics be provided.

C. Analytical Framework

The digital planning framework has been developed to systematically analyse the significant body of supply, demand and other key information gathered to support the digital planning process, which in turn provides the evidence base to recommend priorities on a place and sector-based level. This approach takes into account the significant diversity within the region. Analysis is conducted to provide a view of the current supply and demand situation and a three to five-year forward view. The framework is designed to be flexible, repeatable, easy to use and at the summary level at a glance and guide where to focus action to address the digital divide. Further development of this framework is required in subsequent digital plans.

The planning framework takes inputs from multiple information sources including:

- General regional characteristics
- Supply characteristics at a regional level
- Place-based analysis of population centres, the rural hinterland and key primary production areas, tourist locations and transport corridors
- SLIM database
- The Regional Digital Plans: Common Themes report
- Regional Assembly feedback
- Local government area surveys and onsite fieldwork
- The Digital Inclusion Index
- Australian Bureau of Statistics information
- Other sources highlighted in this document.

Shortfalls in internet access are identified by comparing supply and demand for public network access services classified by technology type (fixed, mobile, Internet of Things and WiFi) in different locations and for the various user groups (businesses, households, communities, visitors and road and rail travellers). This is done by assigning High, Medium and Low ratings (H, M, L) ratings for the supply of, and demand for, these services.

Analysis is first conducted for the present, to understand what needs fixing to catch up to capital city and international standards. It is also done looking forward 3-5 years – where supply is expected to be without further state government intervention relative to where the region needs to be in 3-5 years to be a competitive business location and an attractive place to live and work.

The potential solutions canvassed give a range of options for reducing the digital divide for consideration by the Regional Partnership, local, State and Commonwealth governments and local business and community leaders.

The ‘digital divide’

In essence, the Digital Plan addresses the country-capital city digital divide (access, ability and affordability) by:

- Examining the geographic, demographic, social, economic characteristics of the region and the important structural changes occurring
- Identifying shortfalls in the availability and performance of internet access technologies, in a place and sectoral frame that reflects the region’s characteristics and structural change challenges
- Canvassing priority action to address unmet needs
- Highlighting the need for good information skills gaps and the affordability of digital services.

The usual focus of the digital divide is on the situation in the regions relative to capital city locations. However, the significant diversity in geographic, demographic, social and economic characteristics within a region means there are also digital divides within regions and localities. Accordingly, effective digital planning needs to be place- and sector-specific and able to identify priorities at this detailed level. However, current data limitations mean some of the analysis the this first Mallee digital plan relates to the high-level city-country digital divide and simply acknowledges and discussing the locally-based digital divide issue.

The digital divide between regional Victorian residents, businesses and students and their capital city counterparts – the gap between them in the availability of digital services, the ability of residents and workers to use digital services (digital skills), and the affordability of digital services and digital expertise – is reflected in the RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) which measures these aspects in different locations. This shows a substantial gap between regional Victoria and Melbourne – rural Victoria rated 56 and Melbourne 65. The divide also exists within the region. These digital divides are shown in the charts below.

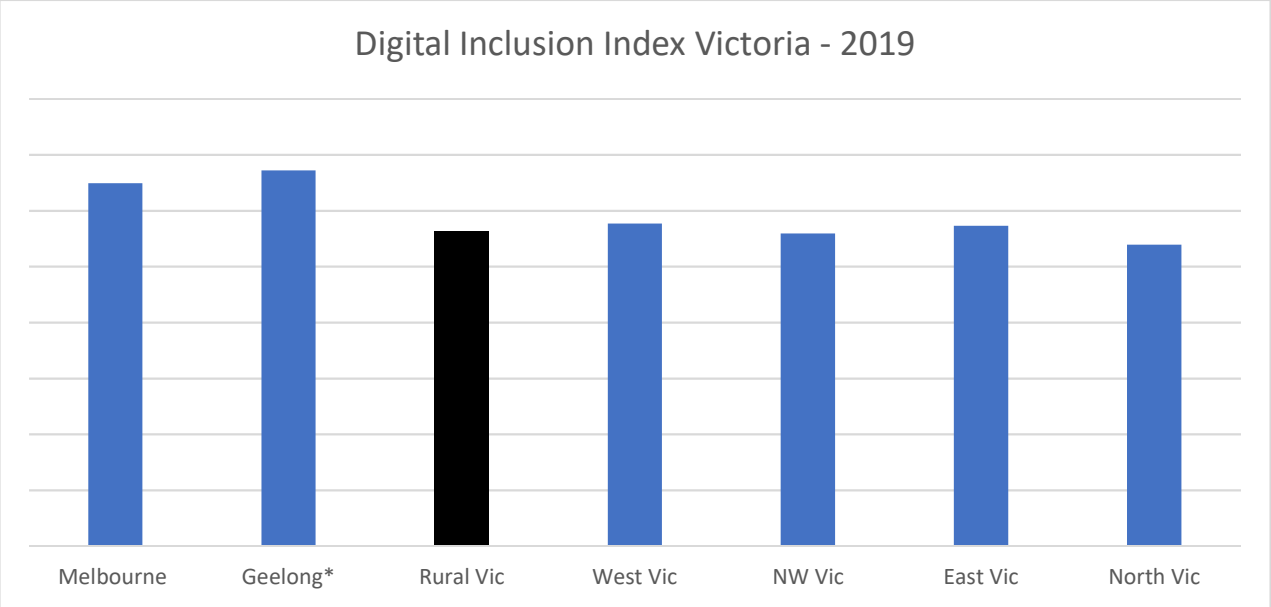

Figure 158 Summary of 2019 RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) findings across Victorian regions

*Sample size <150, exercise caution in interpretation Source: Roy Morgan, April 2018-March 2019Digital divides within localities are driven by the intersection of topography, population density, the inherent performance characteristics of key digital technologies and network deployment economics. These factors cause variations in service quality for standard fixed line technologies, local gaps in mobile coverage, and technology boundary issue. This can result in highly localised 'digital have nots' amongst and contiguous to 'digital haves' and technology coverage boundary issues (e.g. on the fringes of towns).

Digital technologies

Fixed networks provide high speed internet access at a set location (for example an office, factory or residence), currently at a relatively low price compared to mobile access. The NBN, an Australia-wide ubiquitous wholesale public access network will, in conjunction with retail service providers, be the main fixed access means for most Australian households and smaller businesses when completed in 2020. It comprises three core technology types – fixed line (cable-based), fixed wireless and satellite (Sky Muster). NBN fixed line technology in turn comprises fibre to the premise (FTTP – the 'gold standard'), fibre to the curb (FTTC – short copper loops to premises with effective performance close to that of FTTP) and fibre to the node (FTTN – longer copper loops which can degrade service quality).[29]

What this high-level analysis does not show are technology boundary effects that can determine broadband haves and have nots at the local level – that some people in a given location are supplied with different technology and accordingly experience different service quality to their neighbours. For example, where NBN infrastructure cuts over from fixed line to fixed wireless technology (or FTTP to FTTN within fixed line technology),

[29] It is anticipated NBN Co will commence a program of shortening the length of copper loops in FTTN areas once rollout is completed in 2020.

businesses on either side of the boundary will experience different service quality. This will often occur on the fringes of, and sometimes within cities, towns and localities.

The analysis also does not show critical service quality issues that are not due to the NBN infrastructure connecting the users' premises. This includes retail service providers not purchasing enough NBN and backhaul data throughput capacity to meet the speed and reliability needs of users (and advertised service performance).

Awareness of these important issues is essential to understanding the user experience and addressing the various dimensions of the digital divide. The SLIM database provides the means to capture and analyse the locations affected by the above limitations, which will help build the evidence base around these issues. However, this will take time beyond this first iteration of the Digital Plan. In the meantime, fieldwork and case study analysis will be used to build the evidence necessary for effective advocacy for measures which address such service quality anomalies, for example through NBN Co extending its technology boundaries and retail service providers purchasing sufficient data capacity.

Mobile networks provide 'untethered – on-the-move' internet access from three major and one nascent networks (TPG). 3G and 4G mobile technologies are currently in use. Mass deployment of high-performance 5G service is planned to commence in capital cities and larger regional centres in 2020. Coverage (service availability) depends on local topography and the location and aerial orientation of mobile towers, and for these reasons is absent or poor quality in some locations.

The Digital Plan has, by necessity, taken the mobile coverage maps publicly provided by the carriers as the starting point for analysis – better data held by the carriers has not yet been made available. What this necessarily-superficial, second-best analysis does not show is the significant variation in the real-world connectivity experience of mobile users, with many gaps in coverage, and poor-quality service, in areas shown as fully covered.

Furthermore, mobile users have increasingly higher expectations of the services that they can access on smartphones, ranging from traditional voice and critical emergency communications through to web browsing data apps and video streaming. The situations in which people want to access mobile services are also changing. Once primarily considered a service for on-the-move outdoor use, mobile services are increasingly substituting for fixed services in the home and at work for a significant share of users. However, the publicly available coverage maps fail to distinguish between traditional voice and other narrowband services on the one hand, and high quality mobile broadband access on the other – that is, they do not provide enough information for regional users in particular to identify locations where higher bandwidth services will (and will not) work well.

The Victorian Government understands user disappointment and disillusionment with mobile connectivity in regional areas and has joined industry stakeholders in calling for mobile carriers to publish the richer and more accurate coverage data they possess to accurately identify unmet needs and possible ameliorative actions. The Government in conjunction with the Australian Competition and Consumer Commission (ACCC) and the Commonwealth Government is actively pressing the mobile carriers to publish more useful coverage data and supports the ACCC in its public commitment to take regulatory action if cooperative progress is not made.

The SLIM database is capable of capturing and analysing more detailed location-specific information on the availability and quality mobile coverage in regional areas, with improved coverage data to be incorporated in future iterations of SLIM and the digital plans when this becomes available.

Internet of Things networks provide one- and two-way communications between sensors and central data storage and analysis facilities. These can be high bandwidth (HB-IoT) for large data volumes in either direction, or low volume low power (LP) IoT (typically one way, from a remote sensor in a paddock, factory of residence). High bandwidth IoT is currently delivered on existing mobile networks (with wider coverage). LP-IoT is currently provided on LP-WAN networks by operators such as Taggle and Sigfox, although the mobile network operators are examining the technology and business case for providing low power IoT applications on their networks.

Public WiFi networks provide a no-cost-to-user link between mobile devices (e.g. smartphones and tablets) and mobile service providers.[30] Free public WiFi is typically provided by local governments for, disadvantaged citizens, the wider public and visitors in larger cities and towns.[31] Local government WiFi networks also support Smart City applications.

Digital skills

Ensuring wide access to digital technologies can only be effective if consumers and the workforce have the skills to properly take advantage of these developments. Necessary digital skills fall into three broad groups: the general digital literacy of consumers and the workforce (familiarity and competence with every-day digital services), the availability of IT professionals for recruitment and provision of advisory services, and workforce preparedness for successful employment in an age of ongoing digital disruption – the capacity of individuals for independent learning, flexibility, knowledge management, design thinking and innovation and risk-taking.

There are few (if any) direct measures of skills supply and demand (particularly at a place and sector level), requiring local data collection to accurately identify skills gaps and shape needed remedial action.

There are, however, a number of secondary indicators that, taken together, can give a broad indication of skills availability at an LGA and region level – age, education, the proportion of households that access the internet at home, the share of employment in high-technology industries and the 'ability' component of the Digital Inclusion Index.

Matching these supply-side indicators with demand metrics to identify unmet skills is not possible at present – collection of data for this purpose is urgently required.

Digital services affordability

The affordability of digital services (and skills) relative to other regions and Melbourne is a function of both their price and the ability of businesses, local governments and consumers to pay.

There is no clear evidence that public network fixed and mobile access services are more expensive in regional locations, as NBN Co is required to price its wholesale services uniformly Australia-wide, and broadband and mobile service providers price nationally not on a location basis. Nonetheless it is likely many regional users pay more for these services on a quality-adjusted basis – an equally-priced fixed wireless or satellite service does not in general provide the same value-for-money as an equivalent fixed line service. Similarly, an equally-prices mobile service will be lower value-for-money for regional users that frequently experience blackspots and service degraded service.[32]

In addition, unconfirmed anecdotal evidence indicates regional users are not offered the same range of specials and one-off customer retention incentives as their capital city counterparts. Anecdotal evidence also suggests the cost of bespoke connectivity solutions (such as a dedicated fibre connection) is higher in the regions as there are fewer competing suppliers.

Regarding ability to pay, it is well known that annual household incomes in the regions are on average substantially lower than in Melbourne: around $50,000 compared to $80,000. This means regional consumers in general, and these in lower-income regions and LGAs in particular, have a lower ability to pay than their capital city peers. Evidence on the ability to pay of regional businesses compared to this in capital city locations has not

[30] The provider of the free public WIFI service – typically a local government (which may in turn commission a mobile operator to provide the service) meets the cost of the link

[31] Free public WiFi is also provided by the operators of some cafes, fast food restaurants, shopping centres, airports, tourist locations and other commercial premises to improve customers' on-site experience.

[32] The price of IoT services in the regions relative to capital city locations has not yet been conducted, but is expected to be higher on a quality-adjusted basis

been yet been investigated. Finally, a local government IT manager has indicated IT costs are a substantially higher share of the budget in the regions than for local governments in Melbourne.

Priority actions

The options for action lie with both regional stakeholders (local governments, business and community groups and the Regional Partnership), the Victorian Government, the Commonwealth Government, carriers – including evidence-based representations by the Regional Partnership to the various layers of government. Some of the options are high-level and general in nature such as establishing priorities and action plans, while others are technology-specific or focused in a general way on skills gaps. They address the broad shortfalls in the supply of digital services and skills and acknowledge and comment on the frequent boundary and 'Swiss cheese' situation of 'have-nots' amongst the 'haves'. The options outlined address current and future unmet digital needs.

Options for addressing for skills shortfalls are not developed in detail in this version of the Digital Plan due our limited understanding of this issue on a place and sector basis. Rather, data collection is the key immediate imperative. However, it is anticipated that local solutions will be important in addressing digital literacy gaps (including training at digital hubs), state-wide vocational training solutions for shortages of IT professionals, and state-wide school education solutions (STEM++) for digital age workforce preparedness.[33]

Affordability solutions are not addressed in this first-generation digital plan – the collection and analysis the key immediate action.

State Level Information Management (SLIM) database

The State Level Information Management (SLIM) database is an interactive place-based repository of current information on the availability of digital services, key demand drivers and place-based data on the characteristics of each region. The development of the SLIM database is a CRCP initiative funded by the Victorian Government. SLIM has initially been prepared for state government use only from a variety of public and commercial-in-confidence data. The protocols necessary for wide use are being developed to support future versions of the Digital Plans.

[33] Involving the Department of Education and Training.

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