Regional Digital Plan

SUPPORTING EVIDENCE REPORT - GOULBURN





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Introduction

The following Supporting Evidence Report contains the supporting evidence base developed for the Goulburn Digital Plan. The report outlines the technical analysis that has informed the key themes, priorities and recommendations contained within the Goulburn Digital Plan.

The digital connectivity needs of businesses, 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, towns and localities of the region to identify where existing infrastructure is unable to meet current demand for businesses, households and the community.
- Primary Production looks at 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, covering fixed connectivity (for operators to provide on-site WiFi) and mobile coverage
- **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.

Report Structure

This Supporting Evidence Report consists of the following structure:

- Section 1 A summary of the supporting evidence categorised in accordance with the overlays outlined above.
- Section 2 Detailed analysis and commentary on Goulburn's digital connectivity landscape according to the various sector and technology perspectives outlined above.

SECTION 1 – Summary of Analysis

Identified infrastructure gaps

The following table provides a summary of the identified digital connectivity gaps and unmet needs across Goulburn categorised according to the themes outlined above. It also provides a summary of the characteristics of those categories that contribute towards the digital connectivity gap.

Table 1 Summary of demand and unmet need characteristics across different sector and user perspectives

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 in 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

The sections below summarise the identified infrastructure gaps across the region 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 2 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.

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 – 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. Supply of LP-WAN IoT connectivity is rated high *at present* where there is near-complete coverage by one or more networks, noting that network choice is likely to be necessary for a high rating in 3-5 years when IoT is more firmly established in farming and industrial industries. Finally, supply of public WiFi is rated high when it is available in a number of locations in a population centre (medium if available at only one location e.g. a public library)

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 the sections below.

Digital supply and demand rating methodology

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 rates 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 considered in future updates of the Digital Plan.¹

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 three-to-five years, reflecting mobile's importance for all.

Narrowband (LP-WAN) IoT access rating methodology²

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 three-to-five years.

DEMAND

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

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 three-to-five 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.³

¹ Note that decisions on Victorian government funding for mobile blackspots are not based on the high-level mobile coverage maps it is necessary to use in the digital plans

² Sigfox, Taggle and Optus IoT network coverage was considered, NNNCo and mobile network operator IoT coverage was not considered in the plan analysis as this information was not publicly available at the time of analysis. High bandwidth and 2-way IoT are provided by mobile network operators.

³ This broad measure could be improved by using more detailed information on disadvantaged locations from the ABS Socioeconomic Index (SEIFA) and the Jesuit Social Services study *Dropping of the Edge: 2015* (postcode level)

Significant Places Analysis - Summary

Digital supply-demand balance for selected population centres 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 the good coverage indicated by public coverage maps.*

Key findings:

- There are fixed broadband supply issues for businesses in 14 of the 17 places that were analysed for business needs (noting the five smallest localities have only been assessed on household and community needs). This finding highlights the limitations of lower capacity NBN infrastructure like FTTN and fixed wireless to uniformly provide high-speed business-grade services.
- There are fixed broadband supply issues for households in four of the five smallest localities analysed as well as in Beveridge and Nathalia, again reflecting the lower capacity NBN fixed wireless and/or satellite infrastructure currently available in these locations.
- Mobile access appears to be generally good for the significant places analysed, noting that public coverage maps do not reveal specific spots where coverage is weak and services do not meet user needs and expectations. Moving outside these population centres mobile services tend to degrade in quality and reliability.
- There is mixed coverage of LP-WAN / IoT networks but is only identified as an intermediate issue for business in three locations, due to the relatively low demand at present but which is expected to grow strongly in coming years.
- At present, supply of public WiFi is rated an intermediate supply shortfall in 11 of the 22 places analysed, and a major shortfall in another two places, based on having below-average household incomes.

					Acce	ess	
Place	LGA	Name	User type	Fixed Supply / Demand	Mobile* Supply / Demand	LP-WAN IoT Supply / Demand	WiFi Supply / Demand
		Shepparton /	Business	Н/Н	Н/Н	H/M	n.a.
City	Greater	Mooroopna	Home	Н/Н	Н/Н	H/L	H/M
	Shepparton	(pop. 46,194)	Community	n.a.	Н/Н	n.a.	H/M
		Yarrawonga /	Business	Н/Н	Н/Н	H/M	n.a.
	Moira	Mulwala	Home	Н/Н	Н/Н	H/L	M/H
		(pop. 7 <i>,</i> 848)	Community	n.a.	Н/Н	n.a.	M/H
		Maller	Business	M/H	Н/Н	H/M	n.a.
	Mitchell	(pop. 8,521)	Home	Н/Н	Н/Н	H/L	M/L
			Community	n.a.	Н/Н	n.a.	M/L
	Mitchell	Kilmaana	Business	M/H	H/H	H/M	n.a.
Town		Kilmore (pop. 6,953)	Home	н/н	Н/Н	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
		Courseaux	Business	M/H	Н/Н	L/M	n.a.
	Mitchell	(non 5.842)	Home	Н/Н	H/H	L/L	M/H
		(pop. 3,042)	Community	n.a.	Н/Н	n.a.	M/H
		Cabrana	Business	Н/Н	H/H	H/M	n.a.
	Moira	(non 5 376)	Home	н/н	H/H	H/L	M/H
			Community	n.a.	Н/Н	n.a.	M/H
			Business	M/H	H/H	H/M	n.a.

Table 2 Significant places: current unmet digital access needs.

	Greater	Tatura	Home	Н/Н	Н/Н	H/L	M/L
	Shepparton	(pop. 4,052)	Community	n.a.	Н/Н	n.a.	M/L
			Business	M/H	H/H	H/M	n.a.
	Mitchell	Broadford	Home	Н/Н	Н/Н	H/L	L/L
		(pop. 5,797)	Community	n.a.	Н/Н	n.a.	L/L
			Business	M/H	H/H	H/M	n.a.
	Moira	Numurkah	Home	Н/Н	Н/Н	H/L	M/H
		(pop. 5,678)	Community	n.a.	H/H	n.a.	M/H
		_	Business	M/H	H/H	M/M	n.a.
	Strathbogie	Euroa	Home	Н/Н	Н/Н	M/L	M/H
		(pop. 2,902)	Community	n.a.	Н/Н	n.a.	M/H
			Business	M/H	Н/Н	L/M	n.a.
	Murrindindi	Alexandra	Home	Н/Н	Н/Н	L/L	M/H
		(pop. 2,422)	Community	n.a.	Н/Н	n.a.	M/H
			Business	L/H	H/H	H/M	n.a.
	Mitchell	Beveridge	Home	M/H	Н/Н	H/L	L/L
		(pop. 1,877)	Community	n.a.	Н/Н	n.a.	L/L
			Business	M/H	H/H	H/M	n.a.
	Strathbogie	Nagambie (pop. 1,722)	Home	Н/Н	Н/Н	H/L	L/H
			Community	n.a.	Н/Н	n.a.	L/H
	Mitchell	Wandong –	Business	M/H	H/H	H/M	n.a.
		Heathcote Junct (pop. 1,651)	Home	Н/Н	Н/Н	H/L	L/L
			Community	n.a.	н/н	n.a.	L/L
		Nathalia (pop. 1,465)	Business	L/H	Н/Н	H/M	n.a.
	Moira		Home	M/H	Н/Н	H/L	M/H
			Community	n.a.	Н/Н	n.a.	M/H
		Yea (pop. 1,169)	Business	M/H	H/H	L/M	n.a.
	Murrindindi		Home	Н/Н	Н/Н	L/L	M/H
			Community	n.a.	Н/Н	n.a.	M/H
		Kinglaha	Business	M/H	H/H	H/M	n.a.
	Murrindindi	(non 1155)	Home	Н/Н	Н/Н	H/L	M/L
		(pop. 1,133)	Community	n.a.	Н/Н	n.a.	M/L
	Murrindindi	Kinglake West	Home	Н/Н	H/H	H/L	L/L
	Warmana	(pop. 844)	Community	n.a.	Н/Н	n.a.	L/L
	Strathbogio	Avenel	Home	M/H	H/H	M/L	L/M
	Suatinogle	(pop. 844)	Community	n.a.	Н/Н	n.a.	L/M
	Greater	Murchison	Home	M/H	Н/Н	H/L	L/H
LUCAI	Shepparton	(pop. 753)	Community	n.a.	Н/Н	n.a.	L/H
	Moira	Strathmerton	Home	M/H	H/H	H/L	L/M
		(pop. 522)	Community	n.a.	Н/Н	n.a.	L/M
	Mitchell	Pyalong	Home	M/H	Н/Н	H/L	L/M
	WILCHEN	(pop. 433)	Community	n.a.	Н/Н	n.a.	L/M

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 Goulburn cities and larger towns is currently favourable for households generally down to around 800 people, with the exceptions of Beveridge and Nathalia, but fixed broadband access is under par for businesses in most places 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 worse for small towns and localities where NBN fixed wireless prevails. Mobile access appears be generally good for the 22 Goulburn places examined (recognising coverage issues at specific sites and there are concerns regarding the detail of public coverage maps in revealing areas of weak and inadequate coverage).

Coverage of narrowband IoT networks across Goulburn places is mixed but in general not constraining as demand is also low at present. The supply of public WiFi is also varied across the region and not meeting latent demand in 13 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 project trials), widespread fixed access upgrades will be difficult to achieve due to the high cost of these rollouts, particularly in smaller, more remote locations. Furthermore, the delivery of forthcoming 5G mobile coverage in smaller regional locations may lag demand and see these areas lag further behind larger, more densely populated regional cities and towns.

Fixed access

Fixed access for cities and towns with population in excess of 1,000 residents, is predominantly provided by NBN FTTN technology, with the exception of Shepparton/Maroopna, Yarraownga/Mulwala and Cobram which have received relatively expansive rollouts of NBN FTTP and FTTC. While FTTN services satisfactorily meet 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.

Anecdotally we know from stakeholder consultation that the experience of individual users and businesses in an areas can be a real issue. For example, the Nestle factory in Broadford has experienced significant issues with the quality and reliability of its fixed broadband connection affecting the efficiency of its operations and ability to implement new technology-based upgrades and growth opportunities. This experience of a large regional business is likely to be reflected for many other regional businesses, particularly smaller ones with more limited resources to access options to improve services which may be available (for example, through NBN's Technology Choice program).

Looking forward 3-5 years, while NBN FTTP and FTTC networks would support future demand for business-grade services, widespread upgrades will 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 and where there is clear demand from businesses and residents for these higher capacity services, 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 generally good for all the Goulburn cities, towns and localities examined (down to around 400 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 public coverage maps used. Anecdotally we know from regional stakeholders that the 'lived experience' of mobile connectivity is often worse than these coverage maps

suggest, and the reliability and quality of coverage tends to diminish when moving beyond the town centres which was the scope of analysis for significant places in this digital plan.

The 3-5 year outlook is uncertain, as only the larger population centres may receive forthcoming 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 ⁴

While coverage of narrowband IoT networks across Goulburn cities, towns and localities is currently mixed, demand by businesses, local governments and households is also low with only three places identified as having an intermediate supply shortfall 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 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 or medium in all places considered except Shepparton (the location of a CRCP supported free public WiFi trial). Demand is rated medium or high in the locations with below-average household incomes (around half the locations analysed). 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, but may still be relevant for tourists. Monitoring of these 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 Goulburn 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

⁴ Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the Plan analysis as this information is not publicly available.

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.



Primary Production Areas Analysis - Summary

Digital supply-demand balance for selected primary production areas 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:

- There are fixed broadband supply issues for businesses and households in all primary production places analysed, reflecting the lack of quality fixed infrastructure in these more remote, sparsely populated locations
- All areas analysed appear to have good mobile coverage, based on continuous coverage by two or more carriers. However, the reported experience of regional users suggests that service quality issues, especially in these more remote locations, are more pronounced than suggested by the public coverage maps
- 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 forthcoming 5G services to address this shortfall is limited given the cost of delivering these networks to rural and remote areas
- Low bandwidth IoT network supply-demand balance is in transition supply is predominantly reasonable (high or medium) relative to low-level, nascent demand in all but two areas: sheep grazing west of Euroa and beef meat and sheep grazing around Yea. Demand is expected to rise substantially over the next 3-5 years.

				Access	
Land Use	Location	User Type	Fixed Supply / Demand	Mobile* Supply / Demand	LP-WAN IoT Supply / Demand
	South of Cobram	Business	L/H	Н/Н	H/H
Fruit horticulture		Home	M/H	н/н	H/L
	East of Shepparton	Business	L/H	Н/Н	Н/Н
		Home	M/H	н/н	H/L
Grains gropping	South of Yarrawonga	Business	L/H	Н/Н	Н/Н
		Home	M/H	н/н	H/L
Choon grazing	West of Euroa	Business	L/H	Н/Н	M/H
Sheep grazing		Home	M/H	н/н	M/L
Beef meat and	Around Nagambie	Business	L/H	Н/Н	Н/Н
dairy grazing		Home	M/H	н/н	H/L
Beef meat and	Around Yea	Business	L/H	M/H	L/H
sheep grazing		Home	L/H	M/H	L/L

Table 3 Primary production areas: current unmet digital access needs

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 all of them rated low for businesses, but mobile access supply rated high in all (again, noting reservations about the detail and reliability of public coverage maps). LP-WAN 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 – rated as low or medium supply. Business and household demand is,

however, uniformly high, meaning major unmet business demand for fixed access across all 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 improve fixed access supply are likely to be prohibitively expensive.

Mobile coverage

Current situation – Mobile coverage in primary production areas analysed appears to be good based on the public coverage maps apart from beef meat and sheep grazing around Yea. However, the views of regional stakeholders in these areas are unlikely to be as uniformly positive about the quality of mobile services they can access, highlighting the difficulty of evaluating where the 'lived experience' of users presents economic, social and public safety challenges based on these public coverage maps.

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, with better coverage data from carriers important to enable more targeted investments.

Narrowband IoT

Current situation – Narrowband IoT coverage is currently relatively high across most primary production areas analysed apart from sheep grazing west of Euroa and beef meat and sheep grazing around Yea. Demand is variable across the region, but generally in line with current supply, apart from sheep grazing west of Euroa and for beef meat and sheep grazing around Yea where an intermediate and major supply shortfall have been identified respectively.

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.



Tourist Locations Analysis - Summary

Digital supply-demand balance for selected tourist locations 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 the good coverage indicated by public coverage maps.*

Key findings:

- Tourist sites include year-round attractions, periodic events and trails
- Only fixed and mobile connectivity is relevant, with site-specific WiFi services for tourists supported through fixed broadband connectivity of tourism operators
- Most tourism sites analysed have a supply shortfall in fixed connectivity, except for those located in more densely populated regional cities and towns that have received higher quality NBN infrastructure. Poor fixed services compromises tourist operator activities and their ability to deliver WiFi services to visitors
- Four of the 18 tourist sites analysed have an intermediate or major shortfall in mobile connectivity, noting reservations about the reliability and quality of mobile services even in the 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 improve mobile infrastructure in many currently underserved locations given the relatively low population densities.

				Access	
Type	Location	IGA	Type	Fixed	Mobile*
		Greater	Operator	H/H	H/H
	Shepparton Art Museum	Shepparton	Visitor	n.a.	н/н
	Shepparton Sports	Greater	Operator	H/H	Н/Н
	Precinct	Shepparton	Visitor	n.a.	н/н
	Vietnam Veterans	Mitchell	Operator	M/H	Н/Н
	Commemorative Walk	Wittenen	Visitor	n.a.	Н/Н
	X Water Discovery Centre	Murrindindi	Operator	Н/Н	Н/Н
		Marmana	Visitor	n.a.	Н/Н
	Lako Fildon	Murrindindi	Operator	L/H	L/H
			Visitor	n.a.	L/H
Permanent	Stopyonson Falls	Murrindindi	Operator	L/H	M/H
Fernanent	Steavenson rais		Visitor	n.a	M/H
	Lake Mountain Alpine Resort	Murrindindi	Operator	L/H	Н/Н
			Visitor	n.a	Н/Н
	Mitchalton Winory Estato	Strathbogie –	Operator	L/H	Н/Н
			Visitor	n.a	Н/Н
	Mt Wombat Lookout	Strathbogie	Operator	L/H	Н/Н
		Stratinbogie	Visitor	n.a	Н/Н
	Mason Falls	Murrindindi	Operator	L/H	M/H
		wurrinainai	Visitor	n.a	M/H
	Toolangi Sculnture Trail	Murrindindi	Operator	L/H	Н/Н
			Visitor	n.a	Н/Н
		Strathbogie	Operator	L/H	Н/Н

Table 4 Tourist locations: current unmet needs

	Four Vines Running Festival		Visitor	n.a.	н/н
	Alexandra Truck Ute and	Murrindindi	Operator	M/H	Н/Н
	Rod Show	Warmaman	Visitor	n.a.	Н/Н
	Shannartan Fastival	Greater	Operator	Н/Н	Н/Н
E	Shepparton Festival	Shepparton	Visitor	n.a.	Н/Н
Events	GoFish Nagambie	Strathbogie	Operator	L/H	Н/Н
			Visitor	n.a	Н/Н
	Challenge Shepparton	Greater	Operator	Н/Н	Н/Н
		Shepparton	Visitor	n.a	Н/Н
	Seymour Alternative		Operator	M/H	Н/Н
	Farming Expo	Wittenen	Visitor	n.a	Н/Н
Trails	Creat Victorian Bail Trail	Mitchell,	Operator	L/H	M/H
		Murrindindi	Visitor	n.a	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. 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 dayto-day conduct of the business and mobile for both visitors and operators. Three types of tourist locations are considered, permanent tourist attractions, periodic events such as an annual music festival, and trails.

Present situation: Fixed access for site/event operator provision of WiFi is mainly low or medium and inadequate for business needs except for attractions located in larger population centres like Shepparton provisioned with higher capacity fixed broadband infrastructure.

Mobile coverage is mixed with moderate or major supply shortfalls for more remote tourist attractions, with what appears to be reasonable supply for other permanent attractions and some annual events (generally those in or near towns). Looking forward 3-5 years, this pattern is expected to prevail without intervention – it is unlikely market forces alone will sufficiently shift the supply-demand fundamentals in more remote tourist locations to see improved fixed and mobile infrastructure.

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.

Transport Corridors Analysis - Summary

Digital supply-demand balance for selected transport corridors and airports is shown in Table 5, 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.

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
- 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 utilise data services and voice services that drop in and out
- There appears to be reasonable 4G mobile coverage on most 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 from Melbourne to Seymour and Melbourne to Albury/Wodonga.

Road Class	ID	Approx From	Approx To	Comment	Mobile * Supply / Demand
Natar	M31	Wallan	Baddaginnie	Continuous 4G coverage by three carriers	Н/Н
Motorways	M39	Seymour	Toolamba	Continuous 4G coverage by three carriers	н/н
	A39	Toolamba	Tocumwal	Continuous 4G coverage by three carriers	Н/Н
	B300	Yea	Yarck	Continuous 4G coverage by one carrier, coverage under construction by second carrier	M/H
	B340	Eildon	Yarck	Continuous 4G coverage by two carriers, partial coverage by third	Н/Н
A/B	B340	Yea	Seymour	Continuous 4G coverage by one carrier, partial coverage by others	M/H
	B300	Yarck	Merton	Continuous 4G coverage by two carriers, coverage under construction by third carrier	н/н
	B360	Narbethong	Alexandra	Continuous 4G coverage by two carriers, partial coverage by third	н/н
	B300	Kinglake Central	Yea	Continuous 4G coverage by two carriers, partial coverage by third	Н/Н

Table 5 Transport corridors: current unmet needs

	A300	Girgarre Fast	Nalinga	Continuous 4G coverage by three carriers	Н/Н
B400 W		Wyuna East	Esmond	Continuous 4G coverage by two carriers	H/H
	B75	Wallan	Heathcote	Continuous 4G coverage by two carriers	H/H
C	All	27 roads		Low coverage in mountainous areas	L/H
Dail		Melbourne	Seymour	4G coverage by three carriers	H/H
Kali		Melbourne	Albury/Wodonga	4G coverage by three carriers	Н/Н

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 and a rail link, conducted to demonstrate the place-and-sector approach for analysis of digital needs along transport corridors and note any preliminary patterns.

Commentary

The pattern from the sample of major and minor roads is that there appears to be reasonable mobile coverage on major (Class A) thoroughfares and significant (Class B) roads, with poor and less reliable 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.

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

These indicative 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.





Glossary

ABS: Australian Bureau of Statistics

ACCC: Australian Competition and Consumer Commission

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

NB-IoT: Narrowband Internet of Things

BB-IoT: Broadband Internet of Things

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

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

MBSP: Mobile Black Spot Program (Commonwealth Government)

MNO: Mobile network operator

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

SLA: Service Level Agreement

SLIM: State Level Information Management database

VMP: Victoria Mobile Program

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

SECTION 2 – Evidence Base

1 General Characteristics

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



Figure 1 population centres, primary production areas, tourist sites & transport corridors

Population density differs widely across the region – 27 residents per square kilometre for Shepparton LGA, 3 for Strathbogie. Almost a third of the region's population lives in Shepparton, with a further 40 per cent in the other cities, towns and localities. The remaining 30 per cent live 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 Fruit Horticulture south of Cobram and east of Shepparton; Grains cropping south of Yarrawonga; sheep grazing west of Eura and beef, sheep and dairy grazing around Nagambie and Yea.

Tourist sites include year-round attractions and signature annual festivals and other periodic events. The digital connectivity needs of farms and farm households, 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 supplydemand analysis.

Road and rail transport corridors need good mobile coverage for continuous mobile connectivity.

1.1 The land and the people

Key features are:

- North of and adjoining Greater Melbourne at its southern tip
- Approximately 16,500 km² (relatively small)
- Population 162,000 (2017) population density 10 residents /km2 (high for regional Victoria)
- Five local government areas (LGAs) Greater Shepparton (population 66,000), Mitchell (43,000), Moira (29,000), Murrindindi (14,000) and Strathbogie (10,000)
- Main cities and towns: Shepparton (46,000, almost one third of the region's population), Yarrawonga (10,000), Wallan (8,000), Kilmore (7,000), Seymour (6,000) Cobram (5,000) – 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: 31% of population <25 years, 50% 25-64, 19%
 65+ relatively young (30:50:20 average)
- Education: 31% of the population have postsecondary qualifications – lower than regional average (34%)
- Unemployment: 5.7% total, 11.1% youth lower than regional average (5.9% total, 11.5% youth)
- Digital inclusion: mid-ranked on the RMIT-Swinburne-Telstra Digital Inclusion Index⁵

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









⁵ Measuring Australia's Digital Divide – the Australian Digital Inclusion Index 2017

Notably, the residents Moira LGA left school earlier, 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 – at risk of being left behind on digital development.

1.3 The economy

Gross Regional Product (GRP) \$8 billion (mid-sized), with low growth over the past 10 years.

Eight industries make up three quarters of employment in the region:

Health care and social assistance	12.5%
Retail trade	9.8%
Manufacturing	9.8%
Construction	9.6%
Agriculture, forestry, fishing	9.0%
Education and training	7.7%
Accommodation and food services (tourism)	6.3%
Public administration and safety	6.0%
Total	71%

residents are employed across occupational categories as follows:

- Professional (15% of residents), technical & trades (16%), managers (16%)
- Clerical & administration (12%), Community & personal services (11%)
- Labourers (14%), sales (9%), machinery operators
 & drivers (8%)

1.4 Structural change

The top employment industry, health has grown strongly over the past 10 years and is forecast to continue to do so. Conversely, employment in two industries making up similar number of jobs has fallen over the past decade and is forecast to contract or grow only slowly over the next 5 years – manufacturing and retail trade. This suggests that health is the more important industry to embrace digital opportunities, but the growth of retail and manufacturing can also be supported by greater digitalisation.

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, suggesting that both also 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.

Focussing on these industries to step up to a higher level of digital intensity over the next 5 years can ensure best practice efficiency and competitiveness.

Industry	Digi	igital 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			
Education & training		School, home fixed	& mobil	e access		Student fixed & mobile home connectivity, online learning. Augmented & virtual reality in classrooms for enhanced teaching methods			
Construction		Fixed and mobile co	nnectiv	ity		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:	Legend:								

1.5 Digital Intensity – now and in 3-5 years⁶

Analysis of the digital intensity requirements of the eight industries supporting 71 percent of the workforce reveals that six of the industries will rely more heavily on digital services over the next three to five years: healthcare and social assistance, education and training, construction, agriculture/forestry, tourism and retail trade. Three of the industries will move from having a low reliance on digital services to relying heavily on digital services – these include Healthcare and social assistance, Tourism and Agriculture/forestry. To ensure service improvements and productivity gains are achieved for these industries, addressing their increasing digital needs including availability of digital skills is important.

1.6 General Characteristics Informing Digital Planning

This summary of the 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.

⁶ 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 region, with the LGA boundaries marked.

Areas served with FTTP, FTTC and FTTN represent less than 2% 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**.

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 2 An Overview of NBN Technology Coverage of the 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 by the comparatively small size of the region.

		NBN Technology (% Area)		
LGA	Area (km²)	FW	SAT	
Greater Shepparton	2,421	37%	60%	
Mitchell	2,857	22%	76%	
Moira	4,049	39%	60%	
Murrindindi	3,875	10%	90%	
Strathbogie	3,304	20%	80%	
Region (km ²)	16,506	4,165	12,161	

Coverage of Businesses

Across the region, there are 6,064 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 3 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		Approximate Coverage (%)
--	-----	--	--------------------------

⁷ 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.

	No. Bus.	FTTP	FTTB FTTC	FTTN	FW	SAT
Greater Shepparton	2,723	68%	3%	7%	15%	7%
Mitchell	1,206	2%	0%	72%	11%	16%
Moira	1,138	0%	26%	14%	30%	29%
Murrindindi	586	0%	5%	26%	24%	45%
Strathbogie	411	0%	11%	32%	23%	34%
Region (no.)	2,723	1,868	450	1,498	1,125	1,123

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 GNAF⁷ addresses (*see important qualification in footnote*) that lie within residential-zoned areas.



Figure 4 GNAF addresses served by different NBN technologies

LGA	No. Res.	Approximate Coverage (%)					
		FTTP	FTTB FTTC	FTTN	FW	SAT	
Greater Shepparton	25,307	81%	4%	12%	2%	0%	
Mitchell	14,405	12%	0%	81%	5%	2%	
Moira	11,073	3%	44%	29%	15%	9%	

Murrindindi	4,286	0%	4%	42%	21%	32%
Strathbogie	3,008	3%	15%	80%	2%	0%
Region (no.)	58,079	22,784	6,626	21,932	3,857	2,880

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 Moira and Murrindini LGAs. The overall percentage (5.0%) is also higher than the national average and could possibly be higher if the additional dwellings in farming areas were to be included (especially Strathbogie LGA).

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 5 Telstra Public Coverage Map of Region

Telstra's public coverage map indicates good coverage with:

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

By simple visual examination of this map, Telstra appears to support coverage over at least 90% 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; and
- yellow indicates 3G coverage with an external antenna.

By simple visual examination of this map, Optus appears to offer coverage of at least 90% of the landmass, comparable to Telstra.



Figure 6 Optus Public Coverage Map of Region

The most noteworthy gap evident in both Telstra and Optus coverage is in the area of the Grampians. Smaller coverage gaps are scattered across the region, most commonly in areas of hilly terrain.

As for Optus, Vodafone's public coverage maps are based on using a nominated device, and for comparison with the Optus map, an iPhone6 has been assumed.



Figure 7 Vodafone Public Coverage Map of Region

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; and
- shaded areas indicate where coverage enhancements are due to take place in the near future.

Based on the maps, Vodafone's coverage is not as extensive as that of Telstra and Optus but appears to include good coverage of the major roads.

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 OpenSignal⁸ application and database, and a sample of the maps produced from these sources (in this case, in the area of Ararat) is provided below. These applications can provide useful insights into (especially) transport blackspots – but are less useful in assessing wide area coverage because of the difficulties of testing everywhere.



Figure 8 Example of OpenSignal Mapping of Coverage around Ararat

The use of these applications by stakeholders (such as local Government staff) may be valuable in building evidence of transport 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 Government's Mobiles Programs (VMP).

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.

Mobile coverage is discussed in the analysis that is provided in Section 3 for cities, towns and smaller localities in the region. <u>In all cases</u>, 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 off the State and in

⁸ See <u>https://opensignal.com/networks</u>, 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 wellbeing;
- supporting IoT applications; and
- 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 twoway protocol; at this stage, no information about coverage is available
- Thinxtra, with Sigfox technology Sigfox is also a two-way protocol; and

• 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 follows.

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 map⁹. The diagram below shows coverage in the 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 9 Sigfox Coverage of Region.

Based on this map, there may be some coverage around the fringes of the 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 amber 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 10 Taggle Coverage of the Region (SLIM)

⁹ Map derived from Sigfox coverage map published at <u>http://www.sigfox.com/en/coverage</u> (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 22 places selected for analysis in this section include all cities (population¹⁰ > 10,000), all towns (population > 1,000) and the largest locality (population <1000) in each LGA that makes up the region.

In combination, the 22 places accommodate 68.9% of the region's population of 162,475. 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 region is home to another 19 localities with populations of between 185 and 1,000 - in combination representing another 3.7% of the population in the region.

The balance of the region's population (27.4%) is living in communities with a population of less than 185, or on isolated properties (farms and the like). Based on an average Victorian household size of 2.6 as reported by the ABS¹¹, this equates to an estimated 17,115 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 Shepparton-Mooroopna

Shepparton-Mooroopna is a population centre located on the floodplain of the Goulburn River in northern Victoria, approximately 181 kilometres northeast of Melbourne. It began as a sheep station and river crossing in the mid-19th century, before undergoing a major transformation as a railway town. Today it is an agricultural and manufacturing centre, and the centre of the Goulburn Valley irrigation system. The Midland Highway crosses the river between the two towns.

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

- The population of Shepparton-Mooroopna grew by 19.2% over a decade to 46,199 in 2016, well above the median growth rate of 13.3% for the 22 places analysed in the region
- 20,344 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.9% being in full-time employment and 31.3% in part-time employment
- 11.6% of the labour force classified themselves as managers, 18.2% as professionals and 11.9% as clerical and administrative workers
- 6.1% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 2.7% cited aged care residential
- A public and a private hospital are located in the city
- The city has 14 primary schools, 6 secondary schools, 3 primary/secondary schools, a special development school and a TAFE
- With a median age of 37, Shepparton-Mooroopna has one of the youngest populations in regional Victoria and the same median age as Victorian on the whole
- The ABS reports a median annual household income of \$59.2K for Shepparton-Mooroopna, just below the median of \$59.4K for the places analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 1920 businesses in the city or its near surrounds
- In 77.0% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 20.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelor's degree or higher educational qualification
- another 16.8% have completed level III or IV trade certificates; and

¹⁰ All population figures cited in this report are based on the 2016 Census, published by the Australian Bureau of Statistics.

¹¹ 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/censu s/2016/quickstat/2?opendocument).

• another 12.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Greater Shepparton LGA had 5.0% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Shepparton-Mooroopna 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 11 NBN Coverage of Shepparton-Mooroopna (NBN Co)

Our analysis reveals that the city of Shepparton-Mooroopna is predominantly serviced by NBN FTTP and FTTN within the NBN Fixed Line footprint shown above with a few areas on the perimeter of the fixed line footprint with NBN FTTP under construction. NBN fixed wireless services surround the city, except for NBN satellite covering a narrow area from the north to the south of the town. Examining the aerial imagery reveals that the NBN satellite area is mainly dense bushland.



Service available 🛈 🖉 \varTheta Build commenced 🛈 📝 Other fibre provider

Figure 12 Aerial imagery of NBN Fixed Line and Fixed wireless services in Shepparton-Mooroopna (NBN Co) (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) 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 excellent SigFox and Optus agricultural IOT coverage in the region. Testing may be needed to confirm coverage.



Figure 13 SigFox coverage in Shepparton

Public WiFi Coverage

Shepparton has excellent free public WiFi in the CBD. Greater Shepparton is also one of two locations chosen to pilot free WiFi services as part of the CRCP which is planned to be available in late 2019.

Other

VicTrack fibre is not currently available in Shepparton.

3.2 Town of Yarrawonga-Malwala

Yarrawonga-Mulwala a town in the Shire of Moira local government area. The town is situated on the south bank of the Murray River, the border between Victoria and New South Wales and is located approximately 265 kilometres northeast of Melbourne. Yarrawonga's twin town of Mulwala is on the other side of the Murray River. Yarrawonga's main attraction is Lake Mulwala, formed by the damming of the Murray River, immediately downstream of Yarrawonga. The lake is a popular location for activities such as boating, kayaking and fishing.

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

- The population of Yarrawonga-Mulwala grew by 37.0% over a decade to 7,848 in 2016, one of the highest growth rates in the region
- 2,950 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 34.7% in part-time employment
- 11.9% of the labour force classified themselves as managers, 13.7% as professionals and 10.1% as clerical and administrative workers
- 3.8% of the labour force cited their industry of employment as accommodation and 3.3% cited aged care residential
- One public hospital is located in the town
- The town has 2 primary schools, a secondary school and a primary/secondary school
- With a median age of 50, Yarrawonga-Mulwala is older than the median of 44 for the places analysed in the region
- The ABS reports a median annual household income of \$49.8K for Yarrawonga-Mulwala, below the median of \$59.4K for the places analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 231 businesses in the town or its near surrounds
- In 72.9% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 16.2% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 20.3% have completed level III or IV trade certificates; and
- another 10.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Moira 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 Yarrawonga-Mulwala 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 Yarrawonga-Mulwala (NBN Co)

Our analysis reveals that the town of Yarrawonga-Mulwala is predominantly serviced by NBN FTTC with some areas of NBN FTTN across the NBN Fixed Line footprint shown above. NBN fixed wireless services surround the Fixed Line footprint.

Examining the aerial imagery reveals that there are some premises west of Mulwala currently serviced by NBN satellite.



Figure 15 Aerial imagery of Yarrawonga-Mulwala (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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

Taggle and Sigfox coverage is available in Yarrawonga – Mulwala.

Public WiFi Coverage

Free public WiFi is available at the Yarrawonga Library.

Other

VicTrack fibre is not currently available in Yarrawonga-Mulwala.

3.3 Town of Wallan

Wallan, traditionally known as Wallan Wallan (large circular place of water), is a town 45 kilometres from Melbourne. The town sits at the southern end of the large and diverse Shire of Mitchell which extends from the northern fringes of Melbourne into the farming country of north-central Victoria and the lower Goulburn Valley. The township flanks the Northern Highway and is set against the backdrop of the Great Dividing Range. One of the fastest growing towns in the region and now the largest town in the shire, Wallan is a link between the city and rural towns such as Kilmore, Broadford and Seymour.

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

• The population of Wallan grew by 57.5% over a decade to 8,520 in 2016, one of the fastest growth rates in the region
- 4,286 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 59.5% being in full-time employment and 29.0% in part-time employment
- 10.0% of the labour force classified themselves as managers, 12.0% as professionals and 16.0% as clerical and administrative workers
- 3.2% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 2.5% cited primary education
- There is no hospital in the town but there is one located in Kilmore nearby to the north
- The town has a primary school and a secondary school
- With a median age of 35, Wallan has one of the youngest populations in regional Victoria and is younger than the Victorian median of 37
- The ABS reports a median annual household income of \$82.9K for Wallan, one of the highest in regional Victoria and above Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 245 businesses in the town or its near surrounds
- In 88.4% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 19.0% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 21.8% have completed level III or IV trade certificates; and
- another 14.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mitchell LGA had 4.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Wallan 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 Wallan (NBN Co)

Our analysis reveals that the town of Wallan is predominantly served by NBN FTTN in the Fixed Line footprint with some smaller areas to the north, west and south served by FTTP, likely to be new developments. Our analysis reveals that much of the brown areas on the town perimeter under construction are set to receive FTTP.

Examining the satellite imagery reveals NBN fixed wireless services to the north of Wallan and NBN satellite coverage surrounding Wallan predominately servicing unpopulated areas including hilly terrain.



Figure 17 Aerial imagery of Wallan (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) across the entire town.

- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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

Taggle and Sigfox coverage is available in Wallan. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

Free public WiFi is available at the Wallan Library.

Other

VicTrack fibre transits through Wallan following the rail corridor.

3.4 Town of Kilmore

Kilmore is located around 60 kilometres north of Melbourne, in the shire of Mitchell local government area. Kilmore was a stronghold of early Celtic settlers from Ireland, Scotland and Cornwall, and remains a strong Celtic area to this day. Many of Kilmore's oldest extant buildings are made of bluestone including the hospital, old courthouse, former post office, some churches, a gaol, and a monument to Hume and Hovell near the golf course.

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

- The population of Kilmore grew by 47.3% over a decade to 6,952 in 2016, one of the highest growth rates in the region and well above the median growth rate of 13.3% for the 22 places analysed
- 3,057 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 57.3% being in full-time employment and 30.9% in part-time employment

- 10.6% of the labour force classified themselves as managers, 14.6% as professionals and 13.0% as clerical and administrative workers
- 3.3% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 2.8% cited secondary education
- One public hospital is located in the town
- The town has 2 primary schools, a secondary school and a primary/secondary school
- With a median age of 39, Kilmore has one of the younger populations in regional Victoria, and just above the Victorian median of 37
- The ABS reports a median annual household income of \$70.2K for Kilmore, above the median of \$59.4K for the places analysed in the region but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 261 businesses in the town or its near surrounds
- In 82.6% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 20.0% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 21.2% have completed level III or IV trade certificates; and
- another 12.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mitchell LGA had 4.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Kilmore 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 Kilmore (NBN Co)

Our analysis reveals that the town of Kilmore is predominantly serviced by NBN FTTN with some areas of NBN FTTP within the NBN Fixed Line footprint shown above. Areas to the west and south of the town are served by NBN fixed wireless. NBN FTTN and FTTP are under construction in six distinct areas within the Fixed Line footprint.

Examining the satellite imagery shows NBN satellite coverage east, south and north of Kilmore, with several premises residing in this area however, our analysis shows that the north region is proposed to receive NBN fixed wireless.



Service available

Other fibre provide

Figure 19 Aerial imagery of NBN coverage in Kilmore (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) across the entire town.
- Optus shows 4G Plus outdoor coverage across the entire town.

Vodafone shows 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

Taggle and Sigfox coverage is available in Kilmore. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

Free public WiFi is available at the Kilmore Library.

Other

VicTrack fibre is not currently available in Kilmore.

3.5 Town of Seymour

Seymour is a historic railway township located in the Southern end of the Goulburn Valley in the Shire of Mitchell located 104 kilometres north of Melbourne. The town services the surrounding agricultural industries (primarily equine, cattle, sheep and wine) as well as the nearby military base of Puckapunyal.

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

- The population of Seymour declined by 3.6% over a decade to 5,844 in 2016, below the median growth rate of 13.3% for the 22 places analysed in the region
- 2,403 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 52.1% being in full-time employment and 34.7% in part-time employment
- 8.0% of the labour force classified themselves as managers, 11.3% as professionals and 12.1% as clerical and administrative workers
- 2.8% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- One public hospital is located in the town
- The town has 2 primary/secondary schools and a TAFE

- With a median age of 45, Seymour is slightly older than the median of 44 for the 22 places analysed in the region
- The ABS reports a median annual household income of \$49.7K for Seymour, below the median of \$59.4k for the places analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 258 businesses in the town or its near surrounds
- In 70.9% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 14.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.4% have completed level III or IV trade certificates; and
- another 12.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mitchell LGA had 4.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Seymour 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 Seymour (NBN Co)

Our analysis reveals that the town of Seymour is predominantly served by NBN FTTN within the NBN Fixed Line footprint shown above. The coverage map shows a couple of locations to the north and south within the fixed footprint that are likely to receive FTTP Fixed Line services as they appear to be new developments. fixed wireless services surround the Fixed Line footprint with small patches to the north and south of the region served by NBN satellite.

Examining the aerial imagery shows areas in the north and south of the town having access to NBN satellite only, however this area is largely occupied by bushland.



Figure 21 Aerial imagery of NBN coverage in Seymour (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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 are currently no known IOT service provider coverage in Seymour.

Public WiFi Coverage

Free public WiFi is available at the Seymour Library.

Other

VicTrack fibre transits through Seymour following the rail corridor.

3.6 Town of Cobram

Cobram is a town located on the Murray River which forms the border between Victoria and New South Wales. Cobram along with the nearby towns of Numurkah and Yarrawonga is part of the Shire of Moira and is the administrative centre of the Council. Its twin town of Barooga is located on the north side of the Murray River. Surrounding Cobram are a number of orchards, dairy farms and wineries.

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

- The population of Cobram grew by 6.2% over a decade to 5,375 in 2016, below the median growth rate of 13.3% for the 22 places analysed in the region
- 2,088 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 56.1% being in full-time employment and 30.3% in part-time employment
- 11.5% of the labour force classified themselves as managers, 11.3% as professionals and 10.4% as clerical and administrative workers
- 2.8% of the labour force cited their industry of employment as aged care residential and 2.4% cited local government administration
- One public hospital is located in the town
- The town has 2 primary schools, a secondary school, a primary/secondary school and a special development school
- With a median age of 45, Cobram is just older than the median of 44 for the places analysed in the region and above the Victorian median age of 37
- The ABS reports a median annual household income of \$48.5K for Cobram, below the median of \$59.4K for the places analysed in the region and below Melbourne's \$80.4K

- Data in SLIM on businesses registered with Workcover indicates approximately 238 businesses in the town or its near surrounds
- In 68.2% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 14.1% 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; and
- another 11.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Moira 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 Cobram 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 Cobram (NBN Co)

Our analysis reveals that the town of Cobram is predominantly served by NBN FTTC, with a few smaller areas of FTTN and FTTP within the NBN Fixed Line footprint. A couple of new development areas within the NBN Fixed Line footprint (brown striped areas in the map above) are due to receive NBN FTTC and FTTN. Much of the neighbouring town of Booringa has NBN FTTN rollout proposed.

The map above shows larges areas to the north, west and south of the Fixed Line footprint only able to access NBN satellite services. Examining the aerial imagery shows a number of premises in this coverage area. NBN fixed wireless provides coverage to the remaining surrounding areas.



Service available 🕢 🖉 🖲 Build commenced 🕢

Figure 23 Aerial imagery of NBN coverage in Cobram (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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

Extensive Taggle and Sigfox coverage is available in Cobram with Limited Optus Agricultural IOT available. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

Free public WiFi is available at the Cobram Library.

Other

VicTrack fibre is not currently available in Cobram.

3.7 Township of Tatura

Tatura is a town in the Goulburn Valley region of Victoria, situated within the City of Greater Shepparton local government area, 167 kilometres north of Melbourne and 18 kilometres west of Shepparton. With a large corporate and manufacturing presence within the town, Tatura is a major employer within the Goulburn Valley.

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

- The population of Tatura grew by 14.7% over a decade to 4,054 in 2016, just above the median growth rate of 13.3% for the 22 places analysed in the region
- 1,735 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.0% being in full-time employment and 31.0% in part-time employment
- 12.1% of the labour force classified themselves as managers, 16.9% as professionals and 12.5% as clerical and administrative workers
- 4.3% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.7% cited primary school education
- One public hospital is located in the town
- The town has 2 primary schools
- With a median age of 43, Tatura is slightly younger than the median of 44 for the main population centres analysed in the region, but older than the Victorian median of 37
- The ABS reports a median annual household income of \$61.2K for Tatura, higher than the median of \$59.4K for the places analysed in the region but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 122 businesses in the town or its near surrounds
- In 75.2% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 20.7% 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; and
- another 11.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Greater Shepparton LGA had 5.0% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Tatura 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 Tatura (NBN Co)

Our analysis reveals that the town of Tatura is predominantly serviced by NBN FTTC and FTTN with a small area of premises to the north receiving FTTP within the NBN Fixed Line footprint shown above. Our analysis shows that new development areas located in the north and east of the town are scheduled to receive NBN FTTP. Examining the aerial imagery shows NBN fixed wireless services surrounding the town including a number of businesses and premises north west of the NBN Fixed Line footprint.



Figure 25 Aerial imagery of NBN coverage in Tatura (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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

Extensive Optus Agricultural NB-IOT coverage is available in Tatura.

Public WiFi Coverage

Free public WiFi is available at the Tatura Library.

Other

VicTrack fibre is not currently available in Tatura.

3.8 Town of Broadford

Broadford is a small town in central Victoria, approximately 73 kilometres north of Melbourne It is the headquarters of the Shire of Mitchell local government area and is. Broadford is built on the banks of Sunday Creek, a tributary of the Goulburn River. The town grew following the discovery of gold here.

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

- The population of Broadford grew by 24.4% over a decade to 3,800 in 2016, well above the median growth rate of 13.3% for the 22 places analysed in the region
- 1,772 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 57.3% being in full-time employment and 30.4% in part-time employment
- 8.8% of the labour force classified themselves as managers, 9.8% as professionals and 11.3% as clerical and administrative workers
- 2.5% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- The nearest hospital is located in Kilmore to the southeast
- The town has a primary school and a secondary school
- With a median age of 38, Broadford has one of the younger populations in regional Victoria and is just above the Victorian median of 37
- The ABS reports a median annual household income of \$63.1K for Broadford, above the median for \$59.4K for the places analysed in the region but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 131 businesses in the town or its near surrounds
- In 77.9% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 15.6% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 22.0% have completed level III or IV trade certificates; and

• another 12.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mitchell LGA had 4.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Broadford 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 Broadford (NBN Co)

Our analysis reveals that the town of Broadford is predominantly serviced by NBN FTTN with pockets of NBN FTTP planned in new developments in the east and west within the NBN Fixed Line footprint shown above.

As shown in the coverage map above, the areas surrounding the town have access to NBN fixed wireless services. Examining the aerial imagery, there are small pockets of NBN satellite to the north and south of the Fixed Line footprint however there do not appear to be many premises in this area.



Figure 27 Aerial imagery of NBN coverage in Broadford (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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

Taggle coverage is available in Broadford. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

There are no known free public WiFi services available in Broadford.

Other

VicTrack fibre transits Broadford following the rail corridor.

3.9 Town of Numurkah

Numurkah is a town located on the Goulburn Valley Highway, 37 kilometres north of Shepparton, in the Shire of Moira. The town hosts an art show in March, a fishing competition in April, and gokart championships in September and a car show in December.

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

- The population of Numurkah declined by 0.1% over a decade to 3,676 in 2016, below the median growth rate of 13.3% for the 22 places analysed in the region
- 1,486 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.9% being in full-time employment and 32.1% in part-time employment
- 10.3% of the labour force classified themselves as managers, 13.5% as professionals and 10.1% as clerical and administrative workers
- 7.6% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.1% cited secondary education
- One public hospital is located in the town
- The town has 2 primary schools and a secondary school
- With a median age of 48, Numurkah is older than the median of 44 for the places analysed in the region and older than the Victorian median of 37
- The ABS reports a median annual household income of \$46.5K for Numurkah, below the median of \$59.4K for the places analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 127 businesses in the town or its near surrounds
- In 68.4% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 15.6% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 18.5% have completed level III or IV trade certificates; and
- another 10.9% have completed year 12.

ABS Industry employment data from 2016 indicated that the Moira 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 Numurkah 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 28 NBN Coverage of Numurkah (NBN Co)

Our analysis reveals that the town of Numurkah has received an NBN FTTN rollout within the Fixed Line footprint. A small new development area within the Fixed Line footprint has been proposed to receive NBN FTTN services.

Examining the aerial imagery, the immediate area surrounding the fixed line footprint is serviced by NBN fixed wireless providing coverage to several premises to the north, west and south of the Fixed Line footprint. NBN satellite is servicing areas east and south east of Numurkah however, the area is largely bushland and unpopulated terrain.



Figure 29 Aerial imagery of NBN coverage in Numurkah (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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

Optus NB-IOT coverage is available in Numurkah, with limited Taggle and Sigfox coverage also available. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

Free public WiFi is available at the Numurkah Library.

Other

VicTrack fibre is not currently available in Numurkah.

3.10 Town of Euroa

Euroa is a town in the Shire of Strathbogie in the northeast of Victoria, toughly midway between Melbourne and Albury. Euroa's claim to fame is that the National Bank was robbed by Ned Kelly in 1878. Much of the region's wealth once came from sheep but now it comes from horse studs.

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

- The population of Euroa grew by 4.4% over a decade to 2,899 in 2016, below the median growth rate of 13.3% for the 22 places analysed in the region
- 1,148 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 51.4% being in full-time employment and 36.6% in part-time employment
- 13.0% of the labour force classified themselves as managers, 15.3% as professionals and 9.7% as clerical and administrative workers
- 4.0% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.4% cited aged care residential
- The nearest hospitals are located either in Shepparton to the northwest or Seymour to the southwest
- The town has 2 primary schools and a secondary school
- With a median age of 53, Euroa is older than the median of 44 for the places analysed in the region
- The ABS reports a median annual household income of \$43.5K for Euroa, below the median of \$59.4K for the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 140 businesses in the town or its near surrounds
- In 71.2% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 18.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.7% have completed level III or IV trade certificates; and
- another 10.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Strathbogie LGA had 4.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Euroa 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 30 NBN Coverage of Euroa (NBN Co)

Our analysis reveals that the town of Euroa is predominantly serviced by NBN FTTN with a couple of small areas receiving NBN FTTC and NBN FTTP within the NBN Fixed Line footprint shown above.

The coverage map above indicates the immediate surrounds to the NBN Fixed Line area, with the exception of the south east region, having access to NBN fixed wireless where a number of premises appear to be located. The aerial imagery shows the Balmattum Hill Bushland Reserve and a few premises in the NBN satellite region east of the Fixed Line footprint.



Figure 31 Aerial imagery of NBN coverage in Euroa (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town, although coverage reverts to *OUTDOOR* close to the town edge.

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

Limited Optus NB-IOT and Sigfox coverage is available in Euroa. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

Free public WiFi is available at the Euroa Library.

Other

VicTrack fibre is available in Euroa, following the rail corridor.

3.11 Town of Alexandra

Alexandra is a town in Victoria located at the junction of the Goulburn Valley Highway and Maroondah Highway, 26 kilometres west of Eildon, in the Shire of Murrindindi local government area. Many tourists pass through this town on their way to the Mount Buller ski resort from Melbourne. The town contains the Timber Tramway and Museum (located at the Alexandra Railway Station), and the National Trust classified post office and law courts.

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

- The population of Alexandra grew by 13.3% over a decade to 2,425 in 2016, which is the median growth rate of the 22 places analysed in the region
- 1,006 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 54.1% being in full-time employment and 33.5% in part-time employment
- 13.3% of the labour force classified themselves as managers, 14.8% as professionals and 12.6% as clerical and administrative workers
- 6.2% of the labour force cited their industry of employment as local government administration, 4.9% cited accommodation and 4.2% cited aged care residential
- One public hospital is located in the town
- The town has 2 primary schools, and a secondary school
- With a median age of 50, Alexandra is older than the median of 44 for the places analysed in the region
- The ABS reports a median annual household income of \$47.5K for Alexandra, below the median of \$59.4K for the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 124 businesses in the town or its near surrounds
- In 70.8% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

• 20.6% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification

- another 18.9% have completed level III or IV trade certificates; and
- another 10.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Murrindindi LGA had 4.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Alexandra 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 32 NBN Coverage of Alexandra (NBN Co)

Our analysis reveals that the town of Alexandra is predominantly serviced by NBN FTTN within the NBN Fixed Line footprint shown above. NBN fixed wireless services are provided in the areas immediately surrounding the fixed line footprint, except for the south east and a small patch to the west, which is serviced by NBN satellite.

Examining the aerial imagery shows several premises north of the NBN Fixed Line footprint receiving NBN fixed wireless services. NBN satellite provides coverage to small areas to the northwest and southwest and a larger area to the east. There appear to be only a few premises located in these areas.



Figure 33 Aerial imagery of NBN coverage in Alexandra (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) across the entire town.
- Optus shows 3G *outdoor* coverage across the entire town and is constructing new 4G Plus coverage in the 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 no known IOT service coverage available in Alexandra.

Public WiFi Coverage

Free public WiFi is available at the Alexandra Library.

Other

VicTrack fibre is not available in Alexandra.

3.12 Town of Beveridge

Beveridge is a town in Victoria, located along the Hume Highway, 42 kilometres north of Melbourne in the Shire of Mitchell. Beveridge was named after Scottish sheep farmer Andrew Beveridge who built the Hunters' Tryste Inn in 1845. Near Beveridge is Mount Fraser, an eroded extinct volcanic cone. The town is principally known as the birthplace of bushranger Ned Kelly.

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

- The population of Beveridge grew by 449.6% over a decade to 1,874 in 2016, one of the highest growth rates in Victoria
- 921 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 66.6% being in full-time employment and 23.7% in part-time employment
- 10.7% of the labour force classified themselves as managers, 13.3% as professionals and 18.3% as clerical and administrative workers
- 3.3% of the labour force cited their industry of employment as primary education and 2.1% cited aged care residential
- The nearest hospital is located to the south in Craigieburn
- The town has 1 primary school
- With a median age of 31, Beveridge has one of the youngest populations in regional Victoria and well below the Victorian median of 37
- The ABS reports a median annual household income of \$105.4K for Beveridge, one of the highest in Victoria and well above Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 35 businesses in the town or its near surrounds
- In 89.2% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 22.2% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 20.7% have completed level III or IV trade certificates; and
- another 18.9% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mitchell LGA had 4.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Beveridge 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 34 NBN Coverage of Beveridge (NBN Co)

Our analysis reveals that the NBN rollout has largely not reached Beveridge yet, with the town only able to access NBN satellite services.

Examining the aerial imagery shows that the town of Eden Park, which is located adjacent to Beveridge, is currently serviced by NBN Fixed Line services. Areas to the north of Beveridge are under construction to receive NBN fixed wireless services. It is not clear at this stage whether Beveridge will be served with other NBN technology later in the rollout.



Service available 🛈 🔽 🗢 Build commenced 🖓 💽 Other fibre provides

Figure 35 Aerial imagery of NBN coverage in Beveridge (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town, with some 3G *outdoor* coverage in some parts.
- Vodafone shows 4G *outdoor* coverage across the entire town, with new coverage under construction.

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

Taggle coverage is available in Beveridge with limited Sigfox coverage is available in the region. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

There are no know free public WiFi services available in Beveridge.

Other

VicTrack fibre is available in Beveridge, following the rail corridor.

3.13 Town of Nagambie

Nagambie is a town located on the Goulburn Valley Highway north of Seymour and around 122 kilometres north of Melbourne in the Shire of Strathbogie. Nagambie is home to the Nagambie Lakes - which form a regional reservoir, and venue for many state and national rowing championships. The Nagambie Lakes Regatta Centre is one of Victoria's major water sports facilities. Nagambie gives its name to the Nagambie Lakes wine region, a subregion of the Goulburn Valley wine region.

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

- The population of Nagambie grew by 24.7% over a decade to 1,724 in 2016, above the median growth rate of 13.3% for the 22 places analysed in the region
- 746 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 59.2% being in full-time employment and 31.4% in part-time employment
- 15.8% of the labour force classified themselves as managers, 11.9% as professionals and 10.0% as clerical and administrative workers
- 4.1% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.5% cited primary education
- The nearest hospital is located in Seymour to the south
- The town has 2 primary schools
- With a median age of 51, Nagambie is older than the median of 44 for the places analysed in the region and above the Victorian median of 37
- The ABS reports a median annual household income of \$48.1K for Nagambie, below the median of \$59.4K for the places analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 71 businesses in the town or its near surrounds
- In 68.0% 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 20.7% have completed level III or IV trade certificates; and
- another 11.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Strathbogie LGA had 4.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Nagambie 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 x NBN Coverage of Nagambie (NBN Co)

Our analysis reveals that the town of Nagambie is predominantly serviced by NBN FTTN and NBN FTTC with a small area of NBN FTTP to the north of the NBN Fixed Line footprint shown above. A small area north of the town currently has NBN FTTP under construction.

Examining the aerial imagery shows premises north and west of the fixed line footprint serviced by NBN fixed wireless that further extends to the outer regions.



Figure 36 Aerial imagery of NBN coverage in Nagambie (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *outdoor* coverage across the entire town, with new coverage under construction.

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

Optus NB-IOT coverage is available in Nagambie. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

There are no known free public WiFi services available in Nagambie.

Other

VicTrack fibre is not available in Nagambie.

3.14 Town of Wandong-Heathcote Junction

Wandong-Heathcote Junction is a population centre about 50 kilometres north of Melbourne, on the Hume Highway. The town has its own railway station on the Albury-Wodonga and Shepparton railway lines. The town hosts the Wandong Country Music Festival.

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

- The population of Wandong-Heathcote Junction grew by 10.9% over a decade to 1,652 in 2016, below the median growth rate of 13.3% for the 22 places analysed in the region
- 846 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 59.6% being in full-time employment and 30.6% in part-time employment
- 12.0% of the labour force classified themselves as managers, 11.7% as professionals and 13.5% as clerical and administrative workers
- 2.8% of the labour force cited their industry of employment as local government administration and 2.4% cited primary education
- The nearest hospital is located to the northwest in Kilmore
- The town has 1 primary school
- With a median age of 38, Wandong-Heathcote Junction has one of the younger populations in regional Victoria and just above the Victorian median of 37
- The ABS reports a median annual household income of \$89.1K for Wandong-Heathcote Junction, one of the highest in the region and above Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 40 businesses in the town or its near surrounds
- In 86.6% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 20.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 26.9% have completed level III or IV trade certificates; and
- another 13.5% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mitchell LGA had 4.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Wandong-Heathcote Junction 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 37 NBN Coverage of Wandong-Heathcote Junction (NBN Co)

Our analysis reveals that the NBN network is currently under construction in the town of Wandong-Heathcote Junction. The town will predominantly be serviced by NBN FTTN within the NBN Fixed Line footprint shown above. The immediate surrounds of the fixed line footprint are serviced by NBN satellite with patches in the east, west and north west providing NBN fixed wireless services.

Examining the aerial imagery shows few premises outside the NBN Fixed Line footprint in the NBN satellite and NBN fixed wireless coverage.



Figure 38 Aerial imagery of NBN coverage in Wandong-Heathcote Junction (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town, with new coverage under construction.

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

Extensive Taggle coverage and limited and Sigfox coverage is available in Wandong-Heathcote Junction. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

There are no known free public WiFi available in Wandong-Heathcote Junction.

Other

VicTrack fibre is available in Wandong-Heathcote Junction, following the rail corridor.

3.15 Town of Nathalia

Nathalia is a town in northern Victoria located within the Shire of Moira local government area on the banks of Broken Creek and on the Murray Valley Highway. The main industries in Nathalia are cropping, dairy farming and grazing. The Barmah National Park and Murray River is only a short 15 minute drive from Nathalia.

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

- The population of Nathalia grew by 2.4% over a decade to 1,466 in 2016, below the median growth rate of 13.3% for the 22 places analysed in the region
- 602 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 54.0% being in full-time employment and 33.2% in part-time employment
- 10.7% of the labour force classified themselves as managers, 17.0% as professionals and 12.3% as clerical and administrative workers
- 8.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 7.4% cited secondary education and 4.0% cited aged care residential
- One public hospital is located in the town
- The town has 2 primary schools, 2 secondary schools and a primary/secondary school
- With a median age of 48, Nathalia is older than the median of 44 for the places analysed in the region and older than the Victorian median age of 37
- The ABS reports a median annual household income of \$47.7K for Nathalia, below the regional median of \$59.4K for the places analysed and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 58 businesses in the town or its near surrounds
- In 66.3% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

• 16.2% 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; and
- another 10.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Moira 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 Nathalia 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 39 NBN Coverage of Nathalia (NBN Co)

Our analysis reveals that the town of Nathalia is currently serviced by NBN satellite with NBN fixed wireless proposed for the future. NBN fixed wireless currently serves areas to the north of Nathalia and a patch further east of the town. Examining the aerial imagery does not show many premises outside of the town centre.



Figure 40 Aerial imagery of NBN coverage in Nathalia (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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

Extensive Optus NB-IOT coverage is available in Nathalia.

Public WiFi Coverage

Free public WiFi services are available at the Nathalia Library.

Other

VicTrack fibre is not available in Nathalia.

3.16 Town of Yea

Yea is a town located 100 kilometres northeast of Melbourne at the junction of the Goulburn Valley Highway and the Melba Highway, in the Shire of Murrindindi local government area. The town's economy is based around servicing the farming sector, and tourism, with good road links but little public transport. The town has had a fairly stable population (around 1,100) since 1900, though it now has a relatively old population.

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

- The population of Yea grew by 11.2% over a decade to 1,170 in 2016, below the median growth rate of 13.3% for the 22 places analysed in the region
- 456 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 51.1% being in full-time employment and 35.3% in part-time employment
- 9.3% of the labour force classified themselves as managers, 18.4% as professionals and 8.1% as clerical and administrative workers
- 4.7% of the labour force cited their industry of employment as local government administration, 4.4% cited hospitals (except psychiatric hospitals) and 3.3% cited primary education
- One public hospital is located in the town
- The town has 2 primary schools and a secondary school
- With a median age of 53, Yea has one of the oldest populations in the region and is well above the Victorian median age of 37
- The ABS reports a median annual household income of \$44.0K for Yea, below the median of \$59.4K for the places analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 72 businesses in the town or its near surrounds
- In 68.7% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 20.0% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.3% have completed level III or IV trade certificates; and
- another 11.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Murrindindi LGA had 4.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Yea 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 41 NBN Coverage of Yea (NBN Co)

Our analysis of the Fixed Line footprint reveals that the town of Yea is predominantly served by NBN FTTN with a small band of NBN FTTC in the centre of town.

Examining the aerial imagery shows NBN satellite coverage surrounds the town with much of the township falling into the Fixed Line footprint. A limited number of premises and businesses are situated in the NBN satellite coverage area.



Figure 42 Aerial imagery of NBN coverage in Yea (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) 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 no known IOT service coverage available in Yea.

Public WiFi Coverage

Free public WiFi is available at the Yea Library.

Other

VicTrack fibre is not available in Yea.

3.17 Town of Kinglake

Kinglake, comprising forest, farmland, a national park and a town, is located 57 km northeast of Melbourne, in the Kinglake Ranges, part of the Great Dividing Range within the Murrindindi local government area. Many areas of Kinglake overlook the Melbourne skyline to the south west and the Yarra Valley wineries to the south. General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Kinglake declined by 21.8% over a decade to 1,159 in 2016, one of the biggest declines in the region
- 584 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 32.4% in part-time employment
- 11.4% of the labour force classified themselves as managers, 12.8% as professionals and 11.4% as clerical and administrative workers
- 5.1% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.2% cited primary education
- The nearest hospital is located in Healesville to the southeast
- The town has 2 primary schools
- With a median age of 40, Kinglake is younger than the median of 44 for the major places analysed in the region, but older than the Victorian median of 37
- The ABS reports a median annual household income of \$70.4K for Kinglake, one of the highest in the region but still below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 49 businesses in the town or its near surrounds
- In 87.0% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 23.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 26.0% have completed level III or IV trade certificates; and
- another 13.0% have completed year 12.

ABS Industry employment data from 2016 indicated that the Murrindindi LGA had 4.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Kinglake 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 43 NBN Coverage of Kinglake (NBN Co)

Our analysis reveals that the town of Kinglake is served by NBN FTTN within the NBN Fixed Line footprint shown above.

Aerial imagery shows much of the township serviced by NBN Fixed Line services with only a few premises outside the Fixed Line footprint, serviced by NBN satellite.



Figure 44 Aerial imagery of NBN coverage in Kinglake (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 3G *outdoor* coverage across the entire town, with new coverage under construction.

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 extensive Taggle coverage in Kinglake with limited Sigfox coverage available in the region. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

Free public WiFi is available at the Kinglake Library.

Other

VicTrack fibre is not available in Kinglake.

3.18 Locality of Kinglake West

Kinglake West is a town in central Victoria located 56 kilometres northeast of Melbourne. Its local government area is the City of Whittlesea and the Shire of Murrindindi.

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

- The population of Kinglake West was 841 in 2016. The ABS did not report equivalent population statistics for the area in 2006 so the 10-year growth rate cannot be reported.
- 399 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 60.7% being in full-time employment and 29.1% in part-time employment
- 10.5% of the labour force classified themselves as managers, 13.4% as professionals and 12.3% as clerical and administrative workers
- 3.4% of the labour force cited their industry of employment as primary education

- The nearest hospital is located in Healesville to the southeast
- The town has 1 primary school
- With a median age of 37, Kinglake West has one of the youngest populations in the region and the same median age as Victoria
- The ABS reports a median annual household income of \$81.9K for Kinglake West, one of the highest in the region and just above Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 35 businesses in the town or its near surrounds
- In 86.7% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 22.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 27.8% have completed level III or IV trade certificates; and
- another 12.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Murrindindi LGA had 4.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Kinglake West 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 45 NBN Coverage of Kinglake West (NBN Co)

Our analysis reveals that the town of Kinglake West is serviced by a mixture of NBN technologies. NBN FTTN is serviced within the fixed line footprint shown above with NBN fixed wireless surrounding the Fixed Line footprint and NBN satellite coverage provided in the remaining areas of the town. Within the fixed line footprint, to the northwest, east and northeast, NBN FTTN Fixed Line services are planned or under construction.

Examining aerial imagery of the town shows several premises and businesses surrounding the Fixed Line and fixed wireless footprint which are served by NBN satellite. Other technologies do not appear to be planned for these areas.



Figure 46 Aerial imagery of NBN coverage in Kinglake West (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) across the entire town.

- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows partial 3G *outdoor* coverage across parts of the town, with some new coverage under construction.

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 extensive Taggle coverage in Kinglake West with limited Sigfox coverage available in the region. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

There are no known free public WiFi services available Kinglake West.

Other

VicTrack fibre is not available in Kinglake West.

3.19 Locality of Avenel

Avenel is a small town in Victoria located 129 km north of Melbourne. It is in the Shire of Strathbogie local government area. The town was established along the old Hume Highway and the highway now bypasses the outskirts of the town. Avenel was the hometown of Ned Kelly in his younger years. His brother and father are buried in the Avenel cemetery.

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

- The population of Avenel grew by 15.8% over a decade to 843 in 2016, which is above the median growth of 13.3% for the 22 places analysed in the region.
- 400 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 51.8% being in full-time employment and 32.8% in part-time employment
- 17.0% of the labour force classified themselves as managers, 14.7% as professionals and 8.4% as clerical and administrative workers

- 5.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- The nearest hospital is located in Seymour to the southwest
- The town has 1 primary school
- With a median age of 44, Avenel has the same median age as that of the 22 places analysed in the region
- The ABS reports a median annual household income of \$59.7K for Avenel, just above the median of \$59.4K for the places analysed in the region but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 26 businesses in the town or its near surrounds
- In 77.7% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 21.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 22.6% have completed level III or IV trade certificates; and
- another 11.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Strathbogie LGA had 4.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Avenel 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 47 NBN Coverage of Avenel (NBN Co)

Our analysis reveals that the town of Avenel is serviced by NBN fixed wireless. Examining aerial imagery of the same area shows that most of the premises in the township fall within the NBN fixed wireless footprint with NBN satellite providing coverage to a small cluster of dwellings south east of Avenel. A limited number of premises reside in the NBN satellite coverage area east of the town. Other technologies do not appear to be planned for these areas.



Figure 48 Aerial imagery of NBN coverage in Avenel (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 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 limited Optus NB-IOT coverage available in Avenel. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

There are no known free public WiFi services available at the Avenel.

Other

VicTrack fibre is not available in Avenel.

3.20 Locality of Murchison

Murchison is a small riverside rural village located on the Goulburn River in Victoria. Murchison is located 167 kilometres from Melbourne and is just to the west of the Goulburn Valley Highway between Shepparton and Nagambie. The surrounding countryside contains orchards, vineyards and dairy farms.

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

- The population of Murchison declined by 4.3% over a decade to 752 in 2016, one of the lowest growth rates in the region
- 273 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 35.2% in part-time employment
- 12.5% of the labour force classified themselves as managers, 17.3% as professionals and 11.3% as clerical and administrative workers
- 13.5% of the labour force cited their industry of employment as aged care residential and 9.7% cited primary or secondary education
- The nearest hospital is located in Tatura to the north
- The town has 1 primary school

- With a median age of 51, Murchison is older than the median of 44 for the major population centres in the region analysed and older than Victoria's median age of 37
- The ABS reports a median annual household income of \$43.9K for Murchison, below the median of \$59.4K for the places analysed in the region and well 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 70.4% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 15.2% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 20.6% have completed level III or IV trade certificates; and
- another 6.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Greater Shepparton LGA had 5.0% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Murchison 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 49 NBN Coverage of Murchison (NBN Co)

Our analysis reveals that the Murchison township and surrounding areas are serviced by NBN fixed wireless. Other technologies do not appear to be planned for this area.

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* coverage across the entire town, although coverage drops to *outdoor* near the western edge of the 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

Optus NB-IOT coverage is available in Murchison.

Public WiFi Coverage

There are no known free public WiFi services available at the Murchison.

Other

VicTrack fibre is not available in Murchison.

3.21 Locality of Strathmerton

Strathmerton is a small country town in Victoria. It is located in the Shire of Moira local government area on the Murray Valley Highway and Goulburn Valley Highway, about 11 kilometres west of Cobram. The surrounding rural area consists of mainly irrigated dairy and fruit farms. There are several beaches and camping spots just to the north of Strathmerton along the Murray River in and adjacent to the Barmah State Forest.

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

- The population of Strathmerton grew by 12.4% over a decade to 525 in 2016, just below the median growth rate of 13.3% for the 22 major population centres analysed in the region
- 243 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 60.1% being in full-time employment and 26.3% in part-time employment
- 7.3% of the labour force classified themselves as managers, 6.4% as professionals and 7.7% as clerical and administrative workers
- 6.7% of the labour force cited their industry of employment as local government administration
- The nearest hospital is located in Cobram to the east
- The town has 1 primary school
- With a median age of 39, Strathmerton has one of the younger populations in regional Victoria, and just above the Victorian median of 37
- The ABS reports a median annual household income of \$60.4K for Strathmerton, just above the median of \$59.4K for the places analysed in the region but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 16 businesses in the town or its near surrounds
- In 72.7% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 10.6% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 21.5% have completed level III or IV trade certificates; and

• another 12.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Moira 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 Strathmerton 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 50 NBN Coverage of Strathmerton (NBN Co)

Our analysis reveals that the town of Strathmerton and surrounding areas are serviced by NBN fixed wireless. Other NBN technologies do not appear to be planned for this area.

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 *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 extensive Sigfox coverage available in Strathmerton, with limited Taggle and Optus NB-IOT coverage available in the region. Testing should be conducted to determine exact coverage.

Public WiFi Coverage

There are no known free public WiFi services available at the Strathmerton.

Other

VicTrack fibre is not available in Strathmerton.

3.22 Locality of Pyalong

Pyalong is a town in central Victoria, located on the Northern Highway, in the Shire of Mitchell local government area, 90 kilometres from Melbourne. The first Europeans to settle in the area were Alexander Mollison and his brothers who took up the Pyalong station lease in 1838.

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

- The population of Pyalong grew by 61.0% over a decade to 433 in 2016, one of the highest growth rates in regional Victoria
- 202 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.4% being in full-time employment and 29.7% in part-time employment
- 10.6% of the labour force classified themselves as managers, 6.9% as professionals and 12.2% as clerical and administrative workers
- 4.5% of the labour force cited their industry of employment as local government administration
- The nearest hospital is located in Kilmore to the southeast
- The town has 1 primary school
- With a median age of 42, Pyalong is just younger than the median of 44 for the places analysed in the region, and older than the Victorian median of 37

- The ABS reports a median annual household income of \$62.3K for Pyalong, above the median of \$59.4K for the major population centres analysed in the region but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with Workcover indicates approximately 10 businesses in the town or its near surrounds
- In 82.7% of dwellings, at least one person accessed the internet from home

Skills

ABS Census data indicates:

- 14.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 25.7% have completed level III or IV trade certificates; and
- another 11.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mitchell LGA had 4.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in Pyalong 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 51 NBN Coverage of Pyalong (NBN Co)

Our analysis reveals that the town of Pyalong is serviced by NBN fixed wireless. There are areas surrounding Pyalong currently serviced by NBN satellite, but the aerial imagery shows few premises and businesses residing in these areas.



Figure 52 Aerial imagery of NBN coverage in Pyalong (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) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 3G and 4G *outdoor* coverage across some parts of the town, with some new coverage towards the south east under construction.

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 extensive Taggle coverage available in Pyalong.

Public WiFi Coverage

There are no known free public WiFi services available at the Pyalong.

Other

VicTrack fibre is not available in Pyalong



• 4 Primary Production



- 1. Horticulture Fruit Area south of Cobram
- 2. Horticulture Fruit Area east of Shepparton
- 3. Horticulture Grains cropping Area south of Yarrawonga
- 4. Grazing Sheep Area west of Euroa
- 5. Grazing Beef meat / dairy / other livestock Area around Nagambie
- 6. Grazing Beef meat / sheep Area around Yea

4.1 Land Use Classification

The Victorian Land Use Information System subclassifies 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 Grazing – both Dairy (pink) and Grazing sheep & beef (pale green). LGA boundaries are overlaid in red.



Figure 53 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; and
- 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 Goulburn region.



Figure 54 NBN Co Coverage of the Goulburn Region (NBN Co)

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 40% of rural land in the Goulburn has access to

NBN Co's satellite solution, and most of the remainder has access to (or is due to receive) the higherperforming Fixed wireless solution.

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

Population in	Estimated
Rural Land ¹²	Area of
	Population in Rural Land ¹²

¹² 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.

		Satellite Coverage
Greater Shepparton	12,344	15%
Mitchell	13,341	50%
Moira	7,521	30%
Murrindindi	6,991	75%
Strathbogie	4,302	60%

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
- The area south of Cobram

The map below shows most farms in the area have NBN fixed wireless coverage.

Farms located South East of Cobram, in close proximity to the bushland, fall into the NBN satellite footprint.



Figure 55 NBN Coverage of the farming area south of Cobram NBN Co)

Horticulture

- Fruit
- The area east of Shepparton

The map below shows the farming area east of Shepparton have NBN fixed wireless coverage.



Figure 56 NBN Coverage of the farming area east of Shepparton (NBN Co)

Horticulture

- Grains cropping
- The area south of Yarrawonga

The map below shows most of the farms in the area have NBN fixed wireless coverage with small patches of NBN satellite coverage.



Figure 57 NBN Coverage of the farming area south of Yarrawonga (NBN Co)

Grazing

- Sheep
- The area west of Euroa

The map below shows the farming area has NBN fixed wireless coverage.



Figure 58 NBN Coverage of the farming area west of Euroa (NBN Co)

Grazing

- Beef meat / dairy / other livestock
- The area around Nagambie

The map below shows most farms in the area have NBN fixed wireless coverage with the far west and east of Nagambie serviced by NBN satellite.



Figure 59 NBN Coverage of the farming area of Nagambie (NBN Co)

Grazing

- Beef meat / sheep
- The area around Yea

The map below shows most of the farming area around Yea has NBN satellite coverage.

Further analysis reveals grazing land in the south of Yea falls in the NBN FTTN Fixed Line footprint.

Figure 60 NBN Coverage of the farming area south of Yea (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; and
- Other providers (notably Telstra) may be able to provide a service.

More Detailed Supply-Demand Analysis

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.

In this map:

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

Coverage maps published by each of the three major mobile network operators are provided in **Section 2.2**.

Simple visual examination of these maps of Telstra and Optus suggest extensive coverage across the region, with most coverage gaps confined to areas of hilly terrain and national or 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
- The area south of Cobram

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 region.
- Optus shows patchy 4G Plus and 3G *outdoor* coverage across the region, with good coverage focussing around major highways.
- Vodafone shows consistent 4G outdoor coverage across the region, with patches of 3G coverage to the south-east around Boosey.



Figure 61 Telstra coverage south of Cobram



Figure 62 Optus coverage south of Cobram



Figure 63 Vodafone coverage south of Cobram

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

Horticulture

- Fruit
- The area east of Shepparton

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 handheld device coverage across the region, except for patches of 3G *outdoor* coverage between Cosgrove and Cosgrove South.
- Optus shows continuous 4G Plus coverage across the region, except for patches of 3G *outdoor* coverage near Pine Lodge.
- Vodafone shows consistent 4G *outdoor* coverage across the region.







Figure 65 Optus coverage east of Shepparton



Figure 66 Vodafone coverage east of Shepparton

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

Horticulture

- Grains cropping
- The area south of Yarrawonga

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 handheld device coverage in the area, except for an area of 3G *outdoor* coverage and below between Yarrawonga South and Wilby.
- Optus shows continuous 4G Plus coverage in the area, except for patches of 3G *outdoor* coverage near in the same area between Yarrawonga South and Wilby. Optus also shows new coverage under construction in the area.
- Vodafone shows 4G outdoor coverage in the area, but with poor to no coverage in the area south of Telford and Boomahnoomoonah.


Figure 67 Telstra coverage south of Yarrawonga



Figure 68 Optus coverage south of Yarrawonga



Figure 69 Vodafone coverage south of Yarrawonga

In summary, there is good mobile coverage in the area with continuous coverage provided by at least two mobile carriers.

Grazing

- Sheep
- The area west of Euroa

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







Figure 71 Optus coverage west of Euroa



Figure 72 Vodafone coverage west of Euroa

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

Grazing

- Beef meat / dairy / other livestock
- The area around Nagambie

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 no coverage in the area, but some coverage under construction in the residential and highway areas.



Figure 73 Telstra coverage around Nagambie



Figure 74 Optus coverage around Nagambie



Figure 75 Vodafone coverage around Nagambie

In summary, there is good mobile coverage in the area with coverage provided by at least two carriers.

Grazing

- Beef meat / sheep
- The area around Yea

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 handheld device coverage across the valley floor and northward towards Killingworth however there is poor to no coverage in the hilly terrain to both the east and west of Yea.
- Optus shows a similar pattern with good 4G Plus and 3G *outdoor* coverage across the area.
- Vodafone shows consistent some 3G coverage across the area around Yea, but poor to no coverage south of Limestone and north of Molesworth.



Figure 76 Telstra coverage around Yea



Figure 77 Optus coverage around Yea



Figure 78 Vodafone coverage around Yea

In summary, there is good mobile coverage in the valley floor, but poor coverage in the surrounding hilly terrain with only one mobile carrier providing coverage.

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 79 Sigfox coverage in Goulburn region

Based on these maps:

- Sigfox coverage is available towards the central and northern fringes of the region; and
- Taggle coverage appears to be available towards the South-Western region including Kilmore and Seymour.

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
- The area south of Cobram

Taggle and Sigfox coverage appears to be available in and around the area including up to 11 kilometres south of Cobram.

The Optus NB-IOT trial maps show limited coverage in the area.

Horticulture

• Fruit

• The area east of Shepparton

Extensive Optus NB-IOT and Sigfox coverage appears to be available in and around the Shepparton region.

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

Horticulture

- Grains cropping
- The area south of Yarrawonga

Taggle and Sigfox coverage appears to be available in and around the area including up to 10 kilometres south of Yarrawonga.

The Optus NB-IOT trial maps show no coverage in the area.

Grazing

- Sheep
- The area west of Euroa

The SLIM database and public maps for SigFox, and the Optus NB-IOT trials show limited coverage in the west of Euroa.

Grazing

- Beef meat / dairy / other livestock
- The area around Nagambie

Extensive Optus NB-IOT coverage appears to be available in and around the Nagambie region.

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

Grazing

Beef meat / sheep

• The area around Yea

The SLIM database and public maps for SigFox, Taggle IOT and the Optus NB-IOT trials show no coverage in the Yea 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 Goulburn 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.

Of some note, the highest educational attainment in the northern-most local government area is significantly lower than for other local government areas.

LGA	Population	% Year	
		12+	
Greater Shepparton	65,593	49.3%	
Mitchell	42,795	54.2%	
Moira	29,465	46.0%	
Murrindindi	14,167	54.5%	
Strathbogie	10,455	50.6%	
Region	162,475	50.5%	

5 Tourist Destinations

For tourist destinations, 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**, and an overview of mobile coverage outside these centres is provided in **Section 2.2**.

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 Goulburn region features numerous additional tourist attractions and events beyond those covered in this section.

5.1 Shepparton Art Museum

The Shepparton Art Museum is currently located on 70 Welsford St, Shepparton. The museum features diverse works of art with exhibitions and events regularly held here.

The museum is undergoing changes with a new building currently under construction, scheduled to be completed late 2020, on the south-eastern corner of Victoria Park Lake. The five-storey building will house the museum, visitor centre, Kaiela Art Gallery, studio, café and event space and a roof top viewing deck.



Figure 80 Aerial imagery of Shepparton Art Museum

Fixed Broadband

Our analysis reveals the Shepparton Art Museum is serviced by NBN FTTP fixed line within the fixed line footprint. The new building will also fall within the NBN FTTP fixed line footprint.



Figure 81 NBN Coverage of Shepparton Art Museum (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 museum and the future location of the museum.
- Optus shows 4G Plus outdoor coverage of the museum and the future location of the museum.
- Vodafone shows 4G indoor coverage of the museum and the future location of the museum.

In summary, there appears to be 4G coverage of the museum and the future location of the museum from the three mobile network operators.



Figure 82 Telstra mobile coverage of Shepparton Art Museum



Figure 83 Optus mobile coverage of Shepparton Art Museum



Figure 84 Vodafone mobile coverage of Shepparton Art Museum

5.2 Shepparton Sports Precinct

The Shepparton Sports Precinct is located on the corner of Brauman Street and Wyndham Street, Shepparton.

The precinct incorporates the Sports Stadium, Tatura Community Activity Centre, Mooroopna Stadium, athletics area, netball, hockey, football fields and multi-use fields.



Figure 85 Aerial imagery of the precinct

Fixed Broadband

Our analysis reveals the precinct is serviced by NBN FTTP fixed line within the fixed line footprint.



Figure 86 NBN Coverage of Shepparton Sports Precinct (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 precinct.
- Optus shows 4G Plus outdoor coverage of the precinct.
- Vodafone shows 4G indoor coverage of the precinct.

In summary, there appears to be 4G coverage of the precinct from the three mobile network operators.



Figure 87 Telstra mobile coverage of Shepparton Sports Precinct



Figure 88 Optus mobile coverage of Shepparton Sports Precinct



Figure 89 Vodafone mobile coverage of Shepparton Sports Precinct

5.3 Vietnam Veterans Commemorative Walk

The Vietnam Veterans Commemorative Walk is located on High St, Seymour. The Walk is to commemorate all those that took part in the Vietnam War with the names of all the Servicemen and Servicewomen who served in any capacity on 106 panels of DigiGlass. Native trees, grasses that resemble rubber trees, rice paddies and artillery pieces are seen on the walk.



Figure 90 The wall of the Vietnam Veterans Commemorative Walk



Figure 91 Aerial imagery of the Vietnam Veterans Commemorative Walk

Fixed Broadband

Our analysis reveals the location of the walk is serviced by NBN FTTN fixed line within the fixed line footprint.



Figure 92 NBN Coverage of the Vietnam Veterans Commemorative Walk (NBN Co)

Mobile Coverage

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

In summary, there appears to be 4G coverage of the walk from the three mobile network operators.



Figure 93 Telstra mobile coverage of the Vietnam Veterans Commemorative Walk



Figure 94 Optus mobile coverage of the Vietnam Veterans Commemorative Walk



Figure 95 Vodafone mobile coverage of the Vietnam Veterans Commemorative Walk

5.4 Y Water Discovery Centre

The Y Water Discovery Centre is located in the town of Yea, with the wetlands directly adjacent to the centre.

The centre houses an information centre and interactive displays informing visitors of the importance of water resource management and local wetland ecology. The centre also features a gift shop stocking a range of products including locally made items.



Figure 96 Aerial imagery of the Y Water Discovery Centre

Fixed Broadband

Our analysis reveals the centre is serviced by NBN FTTC fixed line within the fixed line footprint.



Figure 97 NBN Coverage of the Y Water Discovery Centre (NBN Co)

Mobile Coverage

- 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 4g coverage of the centre from at least two mobile network operators.



Figure 98 Telstra mobile coverage of the Y Water Discovery Centre



Figure 99 Optus mobile coverage of the Y Water Discovery Centre



Figure 100 Vodafone mobile coverage of the Y Water Discovery Centre

5.5 Lake Eildon

Lake Eildon is situated between Mansfield and Eildon within the Lake Eildon National Park.

The shoreline spans 515km and is particularly popular in the summer months with locals and tourists. Water activities such as boating, skiing, sailing, kayaking and canoeing are enjoyed on the lake. There are numerous camping areas surrounding the lake and hundreds of houseboats floating on the lake.

Note the entire lake has been analysed.



Figure 101 Aerial imagery of Lake Eildon



Figure 102 Houseboat on Lake Eildon¹³

Fixed Broadband

Our analysis reveals the larger communities around the lake are serviced by NBN fixed wireless, with most other areas and the lake itself falling into the NB satellite footprint.

¹³ https://www.visitmelbourne.com/regions/high-country/things-todo/nature-and-wildlife/national-parks-and-reserves/vv-lake-eildonnational-park



Figure 103 NBN Coverage of Lake Eildon (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), 4G device and 3G device coverage of the lake. Small blackspots are evident east of the lake however, campgrounds do not appear to be situated in these areas.
- Optus shows 4G Plus outdoor and 3G outdoor coverage of the lake however, blackspots are evident in the south where campsites are situated, Delatite Arm Reserve campsite further north, Fraser camping area and areas on the lake.
- Vodafone shows 4G indoor, 4G outdoor and 3G outdoor coverage of the lake however, blackspots are evident at Candlebark camping area, campsites further south and east and areas on the lake. Coverage improvements are under construction in large areas around the lake.

In summary, there appears to be partial coverage of the lake and campgrounds from the three mobile network operators.



Figure 104 Telstra mobile coverage of Lake Eildon



Figure 105 Optus mobile coverage of Lake Eildon



Figure 106 Vodafone mobile coverage of Lake Eildon

5.6 Steavenson Falls

Steavenson Falls is located 4km south-east of Marysville. It is one of Victoria's highest waterfalls with a total drop of 84 metres into the Steavenson River Valley. The falls can be viewed from a purpose built platform, by walking 350 metres from the carpark.



Figure 107 Aerial imagery of Steavenson Falls

Our analysis reveals the falls and surrounding area is serviced by NBN satellite.



Figure 108 NBN Coverage of Steavenson Falls (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 Falls Rd leading to the carpark however, there does not appear to be coverage of the carpark and falls.
- Optus shows 4G Plus outdoor and 3G outdoor device coverage of the walk, falls and Falls Rd leading to the carpark.
- Vodafone shows 3G outdoor coverage of the walk and falls however, no coverage is evident on Falls Road close to the carpark.

In summary, there appears to be coverage of the walk and falls from two of the three mobile network operators with partial coverage from the third operator.



Figure 109 Telstra mobile coverage of Steavenson Falls



Figure 110 Optus mobile coverage of Steavenson Falls



Figure 111 Vodafone mobile coverage of Steavenson Falls

5.7 Lake Mountain Alpine Resort

The Lake Mountain Alpine Resort is a two-hour drive from Melbourne and 22km from Marysville.

The resort attracts approximately 200,000 visitors throughout the year with plenty of activities to participate in during the cooler and warmer months.



Figure 112 Aerial imagery of Lake Mountain Alpine Resort

Our analysis reveals the resort falls within the NBN satellite footprint.



Figure 113 NBN Coverage of Lake Mountain Alpine Resort (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 resort.
- Optus shows 4G Plus outdoor and 3G outdoor device coverage of the resort however, 4G Plus outdoor is scheduled for the area.
- Vodafone shows limited 3G outdoor coverage of the resort.

In summary, there appears to be coverage of the resort from two of the three mobile network operators with partial coverage from the third operator however, coverage signals and speed may be affected during peak season.



Figure 114 Telstra mobile coverage of Lake Mountain Alpine Resort



Figure 115 Optus mobile coverage of Lake Mountain Alpine Resort



Figure 116 Vodafone mobile coverage of Lake Mountain Alpine Resort

5.8 Mitchelton Winery Estate

The Mitchelton Winery Estate is located at 470 Mitchellstown Road, Nagambie. The winery is set in the Goulburn Valley where visitors can experience the hotel, day spa and restaurant.



Figure 117 Aerial imagery of Mitchelton Winery

Our analysis reveals the winery falls within the NBN satellite footprint.



Figure 118 NBN Coverage of Mitchelton Winery (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 winery.
- Optus shows 4G Plus outdoor coverage of the winery.
- Vodafone shows 4G outdoor coverage of the winery.

In summary, there appears to be 4G coverage of the winery from the three mobile network operators.



Figure 119 Telstra mobile coverage of Mitchelton Winery



Figure 120 Optus mobile coverage of Mitchelton Winery



Figure 121 Vodafone mobile coverage of Mitchelton Winery

5.9 Mt Wombat Lookout

The Mt Wombat lookout is located on Mt Wombat in Strathbogie and can be reached from Euroa-Strathbogie Road. There is a road straight to the top of the lookout or alternatively, the car can be parked halfway with the rest of the journey on foot. There are picnic spots on the way to the lookout.



Figure 122 Aerial imagery of Mt Wombat Lookout

Our analysis reveals the lookout and surrounding area falls within the NBN satellite footprint.



Figure 123 NBN Coverage of Mt Wombat Lookout (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 lookout.
- Optus shows 4G Plus outdoor and 3G outdoor coverage of the lookout however, 4G Plus is scheduled for the area.
- Vodafone shows 4G outdoor coverage of the lookout.

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



Figure 124 Telstra mobile coverage of Mt Wombat Lookout



Figure 125 Optus mobile coverage of Mt Wombat Lookout



Figure 126 Vodafone mobile coverage of Mt Wombat Lookout

5.10 Mason Falls

Mason Falls is located in Kinglake West within the Kinglake National Park. There are picnic facilities close to the falls including shelter, free gas barbeques, tables and toilets. The falls can be accessed by a short walk from the picnic area.



Figure 127 Aerial imagery of Mason Falls



Figure 128 Mason Falls Lookout¹⁴

Our analysis reveals the falls and surrounding area is serviced by NBN satellite.



Figure 129 NBN Coverage of Mason Falls (NBN Co)

Mobile Coverage

Based on public coverage maps:

• Telstra shows 3G device coverage of the fall's lookout and picnic area.

- Optus shows 4G Plus outdoor coverage of the fall's lookout and picnic area.
- Vodafone shows 3G outdoor coverage of the fall's lookout and picnic area.

In summary, there appears to be coverage of the fall's lookout and picnic area from the three mobile network operators.



Figure 130 Telstra mobile coverage of Mason Falls



Figure 131 Optus mobile coverage of Mason Falls



Figure 132 Vodafone mobile coverage of Mason Falls

¹⁴ https://www.visitmelbourne.com/regions/high-country/things-todo/nature-and-wildlife/national-parks-and-reserves/masons-falls

5.11 Toolangi Sculpture Trail

The Toolangi Sculpture Trail was first created in 1996 by nine Australian and international artists in the Toolangi forest. The sculptures have been created from the natural materials from the forest. The trail is 1.5 kilometres in length.



Figure 133 Aerial imagery of Toolangi Sculpture Trail

Fixed Broadband

Our analysis reveals the trail and surrounding area is serviced by NBN satellite.



Figure 134 NBN Coverage of the Toolangi Sculpture 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) of the trail.
- Optus shows 4G Plus outdoor coverage of the trail.

Vodafone shows mostly 4G outdoor and 3G outdoor coverage of the trail. The trail is on the edge of coverage noting the maps may not be accurate.

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





Figure 135 Telstra mobile coverage of Toolangi Sculpture Trail



Figure 136 Optus mobile coverage of Toolangi Sculpture Trail



Figure 137 Vodafone mobile coverage of Toolangi Sculpture Trail

5.12 Four Vines Running Festival

The Four Vines Running Festival is a six-race running festival based on the banks of the Goulburn River

Valley in Nagambie. The four wineries featured in the races are Fowles Wines, Box Grove Vineyard, Mitchelton wines and Tahbilk Winery. The festivities take place at Tahbilk Winery with live music and entertainment and kid's activities.



Figure 138 Aerial imagery of the Tahbilk Winery

Fixed Broadband

Our analysis reveals the Tahbilk Winery is serviced by NBN fixed wireless.



Figure 139 NBN Coverage of Tahbilk Winery (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 Tahbilk Winery.
- Optus shows 4G Plus outdoor coverage of Tahbilk Winery.
- Vodafone shows 4G indoor and outdoor coverage of Tahbilk Winery.

In summary, there appears to be 4G coverage of Tahbilk Winery from the three mobile network operators.



Figure 140 Telstra mobile coverage of Tahbilk Winery



Figure 141 Optus mobile coverage of Tahbilk Winery



Figure 142 Vodafone mobile coverage of Tahbilk Winery

5.13 Alexandra Truck Ute and Rod Show

The Alexandra Truck Ute and Rod Show is held over the Queen's Birthday long weekend every year in Alexandra. The show features different varieties of trucks, a wood chopping competition, hot rods and live bands on Grant St.

The event attracts up to 15,000 people each year which benefits the local businesses and fundraisers.



Figure 143 Aerial imagery of Grant St Alexandra

Our analysis reveals the location of the show is serviced by NBN FTTN fixed line within the fixed line footprint.



Figure 144 NBN Coverage of Grant St Alexandra (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 event location.
- Optus shows 4G Plus outdoor coverage of the event location.
- Vodafone shows 4G outdoor coverage of the event location.

In summary, there appears to be 4G coverage of the event location from the three mobile network operators.



Figure 145 Telstra mobile coverage of the event location



Figure 146 Optus mobile coverage of the event location



Figure 147 Vodafone mobile coverage of the event location

5.14 Shepparton Festival

The Shepparton Festival is held annually every March in various venues throughout Greater Shepparton. The venues include the La Trobe University, Victoria Park Lake, Tallis Wine in Dookie, Riverlinks Westside and many more.

Since its inception in 1997, the festival has become Greater Shepparton's premier art, culture, food and community festival.



Figure 148 A performance at the festival¹⁵



Figure 149 Aerial imagery of Shepparton Festival locations

Our analysis reveals the majority of the festival events are held in Shepparton-Mooroopna which are serviced by NBN FTTP fixed line.

The venues in towns outside of Shepparton-Mooroopna which include Dookie, Murchison, Kialla and Toolamba, are serviced by NBN fixed wireless.

The analysis is based on the event locations chosen for the 2019 festival.



Figure 150 NBN Coverage of Shepparton Festival locations (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 event locations.
- Optus shows 4G Plus outdoor coverage of the event locations.
- Vodafone shows 4G indoor coverage of the venues in Shepparton-Mooroopna with 4G outdoor coverage in Murchison, Dookie and Toolamba.

In summary, there appears to be 4G coverage of the event locations from the three mobile network operators.



Figure 151 Telstra mobile coverage of festival event locations

¹⁵ http://visitshepparton.com.au/events/showcaseevents/!/view/shepparton-festival-4



Figure 152 Optus mobile coverage of the festival event locations



Figure 153 Vodafone mobile coverage of the festival event locations

5.15 GoFish Nagambie

GoFish Nagambie is Australia's largest and richest freshwater fishing competition and outdoor lifestyle event held on the banks of the Goulburn River and Nagambie Lakes. The festival hub is located at the Nagambie Lakes Regatta Centre.

The tournament zone spans 30km from Goulburn River to Hughes Creek. Powered and unpowered campsites are available to book complete with toilets, showers and drinking water facilities. The campsite is located off Mitchellstown Road across the river from Mitchellstown Streamside Reserve.



Figure 154 Map of the Tournament Zone¹⁶



Figure 155 Aerial imagery of Nagambie Lakes Regatta Centre and campsite

Fixed Broadband

Our analysis reveals the Nagambie Lakes Regatta Centre and campsite are serviced by NBN fixed wireless.

¹⁶ https://www.gofishnagambie.com.au/tournament/tournament-zone



Figure 156 NBN Coverage of Nagambie Lakes Regatta Centre and campsite (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 centre and campsite. 4GX and 3G device coverage is shown in the tournament zone.
- Optus shows 4G Plus outdoor coverage of the centre and campsite. 4G Plus outdoor coverage is predominately shown in the tournament zone with small patches of 3G outdoor further south.
- Vodafone shows 4G outdoor coverage of the centre and 4G indoor coverage of the campsite.
 4G indoor and outdoor coverage is shown in the tournament zone with a small patch of 3G outdoor further south.

In summary, there appears to be coverage of the centre, campsite and tournament zone from the three mobile network operators.



Figure 157 Telstra mobile coverage of the GoFish Tournament



Figure 158 Optus mobile coverage of the GoFish Tournament





5.16 Challenge Shepparton

The Challenge Shepparton triathlon is held annually in November with the course starting and finishing at Victoria Park Lake precinct.

The triathlon features a 1.9km swim, 90km bike ride and 21.1km run. The swim takes place at Victoria Park Lake and the bike course travels down to Old Toolamba returning to the lake. The run course travels on the outskirts of the lake then further north and returns to the finish line at the lake.



Figure 160 Aerial imagery of the triathlon course

Our analysis reveals the Victoria Park Lake precinct is serviced by NBN FTTP fixed line within the fixed line footprint.



Figure 161 NBN Coverage of Victoria Park Lake (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 Victoria Park Lake and the triathlon course.
- Optus shows 4G Plus outdoor coverage of Victoria Park Lake and the triathlon course.
- Vodafone shows 4G indoor coverage of Victoria Park Lake and 4G indoor and outdoor coverage of the triathlon course.

In summary, there appears to be 4G coverage of Victoria Park Lake and the triathlon course from the three mobile network operators.



Figure 162 Telstra mobile coverage of the Victoria Park Lake and triathlon course



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163 Optus mobile coverage of the Victoria Park Lake and triathlon course



Figure 164 Vodafone mobile coverage of the Victoria Park Lake and triathlon course

5.17 Seymour Alternative Farming Expo

The Seymour Alternative Farming Expo is held in February every year at Kings Park in Seymour.

The three-day event features approximately 450 exhibitors informing visitors of the latest technology and practices in small and backyard farming. The expo attracts approximately 22,000 visitors over the three days.



Figure 165 Aerial imagery of Kings Park



Figure 166 Kings Park¹⁷

Our analysis reveals Kings Park is serviced by NBN FTTN fixed line within the fixed line footprint.



Figure 167 NBN Coverage of Kings Park (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 Kings Park.
- Optus shows 4G Plus outdoor coverage of Kings Park.
- Vodafone shows 4G indoor coverage of Kings • Park.

In summary, there appears to be 4G coverage of Kings Park from the three mobile network operators however, coverage signals and speed may be affected by the increased number of visitors at the event.



Figure 168 Telstra mobile coverage of Kings Park



169 Optus mobile coverage of Kings Park



Figure 170 Vodafone mobile coverage of Kings Park

5.18 Great Victorian Rail Trail

The Great Victorian Rail Trail is the longest rail trail in Victoria, spanning 134kms in length from Tallarook to Mansfield. The mostly flat terrain can be experienced by foot, bike or horse and travels by rivers, valleys, lakes and mountains.

¹⁷ https://www.visitmelbourne.com/regions/daylesford-and-themacedon-ranges/events/gardens-and-agriculture/seymouralternative-farming-expo

The towns touched on the trail that fall within the Goulburn region are Tallarook, Yea, Molesworth, Alexandra and Yarck. A range of accommodation options are available in the towns.



Figure 171 Aerial imagery the trail



Figure 172 Map of the Great Victorian Rail Trail

Fixed Broadband

Our analysis reveals the towns visited on the trail in the Goulburn region are serviced by a mixture of technologies.

Molesworth and Yarck are serviced by NBN satellite with fixed wireless servicing the town of Tallarook. Yea is serviced by NBN FTTN and FTTC fixed line and Alexandra is serviced by predominately FTTN fixed line.



Figure 173 NBN Coverage of the Great Victorian Rail 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) and 3G device coverage of the rail trail with small blackspots evident between Yea and Molesworth.
- Optus shows 4G Plus outdoor and 3G outdoor of the rail trail with small blackspots evident between Tallarook and Molesworth. 4G Plus is scheduled for sections of the trail.
- Vodafone shows 4G indoor, 4G outdoor, 3G indoor and 3G outdoor coverage of the rail trail however, blackspots are evident between Yea and Molesworth.

In summary, there appears to be near continuous coverage from the three mobile network operators.



Figure 174 Telstra mobile coverage of the Great Victorian Rail Trail



Figure 175 Optus mobile coverage of the Great Victorian Rail Trail



Figure 176 Vodafone mobile coverage of the Great Victorian Rail 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. In the case of road transport, the main indicator of demand is the road classification (designated M/A, B or C-grade roads)¹⁸. 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.

¹⁸ "A" and "B" routes are arterial highways (classification AH). "C" routes typically link smaller population centres to larger regional centres, or roads (classification AO).



Figure 177 Goulburn region declared roads and rail routes

6.2 Freeways/Motorways

Practical experience of call dropouts and coverage blackspots when driving some of the roads suggests that the carrier coverage maps tend to overstate the quality of coverage, however cars fitted with external antennae will receive more consistent coverage.

There is one motorway in the region running from Melbourne to the Sydney. The results of a visual scan of public carrier maps is shown below.

M31 Hume Freeway (~143km)

- From near Wallan
- To Baddaginnie (near Violet Town)

Maps show continuous 4G *outdoor* coverage or better by all three mobile carriers. Vodafone is constructing significant new coverage in the area around Kilmore and Seymour. This is considered to be a result of the Regional Rail Connectivity Project investment to improve rail coverage between Melbourne and Seymour.

M39 Hume Freeway (~143km)

- From near Seymour
- End of dual carriageway near Toolamba

Maps show continuous 4G *outdoor* coverage or better by all three mobile carriers. Vodafone is constructing significant new coverage in the area around Seymour. This is considered to be a result of the Regional Rail Connectivity Project investment to improve rail coverage between Melbourne and Seymour.

6.3 A/B Grade Roads

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

Highway Name	Approx	Approx	Dist
	Start	End	(km)
A39 GOULBURN VALLEY HIGHWAY	End of dual carriageway near Toolamba	Tocumwal	97

B300 GOULBURN VALLEY HIGHWAY	Yea	Yarck	17
B340 GOULBURN VALLEY HIGHWAY	Eildon	Yarck	39
B340 GOULBURN VALLEY HIGHWAY 2	Yea	Hume Freeway near Seymour	43
B300 MAROONDAH HIGHWAY	Yarck	Merton	20
B360 MAROONDAH HIGHWAY	Narbethong	Alexandra	51
B300 MELBA HIGHWAY	Kinglake Central	Yea	40
A300 MIDLAND HIGHWAY	Girgarre East	Nalinga	121
B400 MURRAY VALLEY HIGHWAY	Wyuna East	Esmond	130
B75 NORTHERN HIGHWAY	Wallan	Heathcote	59

A39 Goulburn Valley Highway (~97km)

- Near Toolamba
- Victorian border near Tocumwal

This highway connects the Hume Freeway (via the Goulburn Valley Freeway) to Nerandera in NSW via the regional city of Shepparton. The section of the highway in the region ends at the Victorian border near Tocumwal.



Figure 178 A39 Goulburn Valley Highway within the Region (Google)

- Telstra shows continuous 4GX *outdoor* coverage
- Optus shows continuous 4G outdoor coverage
- Vodafone shows continuous 4G *outdoor* coverage or better







Figure 180 Optus coverage on Melba Highway



Figure 181 Vodafone coverage on Melba Highway

Based on public coverage maps, there appears to be continuous 4G *outdoor* coverage by all three mobile carriers.

B300 Goulburn Valley Highway (~17km)

- From Yea
- To near Yarck

This short section of highway helps to connect regional towns and highways servicing the area.



Figure 182 B300 Goulburn Valley Highway

- Telstra shows continuous 4GX and 3G *outdoor* coverage across the entire route
- Optus shows good coverage over the route, however there are patches of poor to no coverage around Cathkin and significant new coverage under construction around Yarck
- Vodafone shows 4G and 3G outdoor coverage across most of the route, however there are black spots near Molesworth.



Figure 183 Telstra coverage on B300 Goulburn Valley Highway



Figure 184 Optus coverage on B300 Goulburn Valley Highway



Figure 185 Vodafone coverage on B300 Goulburn Valley Highway

In summary, there appears to be continuous 4G *outdoor* coverage by one mobile carrier, with a second carrier constructing additional coverage in the area.

B340 Goulburn Valley Highway (~39km)

- From Eildon
- Near Yarck

This highway connects the Eildon township to the region's highway network near Yarck via Alexandra.



Figure 186 B340 Goulburn Valley Highway to Eildon (Google)

- Telstra shows continuous 4GX *outdoor* coverage across the route
- Optus shows continuous 3G coverage across the route, with all coverage in the process of being upgraded to 4G
- Vodafone shows continuous coverage across the route.



Figure 187 Telstra coverage on B340 Goulburn Valley Highway



Figure 188 Optus coverage on B340 Goulburn Valley Highway



Figure 189 Vodafone coverage on B340 Goulburn Valley Highway

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

B340 Goulburn Valley Highway (~43km)

- From Yea
- Hume Highway near Seymour

This highway connects the Yea township to Hume Freeway via Seymour.



Figure 190 B340 Goulburn Valley Highway between Yea and Hume Highway near Seymour (Google)

Based on public coverage maps:

- Telstra shows continuous 4GX outdoor coverage across the majority of the route, however coverage around Kerrisdale is poor with areas of 3G external antenna and no coverage
- Optus shows very poor coverage (3G handheld, 3G external antenna and no coverage) across most of the route, recovering on the approach to Seymour
- Vodafone shows continuous 3G outdoor coverage or better across the entire route, with significant coverage upgrades under construction around Seymour



Figure 191 Telstra coverage on B340 Goulburn Valley Highway



Figure 192 Optus coverage on B340 Goulburn Valley Highway



Figure 193 Vodafone coverage on B340 Goulburn Valley Highway

Based on public coverage maps, there appears to be only one mobile provider claiming consistent coverage over the entire route.

B300 Maroondah Highway (~20km)

- From Yarck
- Near Merton

This highway connects the Yarck township to near Merton.



Figure 194 B300 Maroondah Highway between Yarck and Merton (Google)

Based on public coverage maps:

- Telstra shows continuous 4GX outdoor coverage across the route
- Optus shows continuous 3G outdoor coverage across the route, with significant coverage upgrades under construction across the majority of the route
- Vodafone shows continuous 4G outdoor and indoor coverage across the route.



Figure 195 Telstra coverage on B300 Maroondah Highway



Figure 196 Optus coverage on B300 Maroondah Highway



Figure 197 Vodafone coverage on B300 Maroondah Highway

Based on public coverage maps, there appears to be continuous 4G coverage by two of three mobile carriers with significant coverage upgrades by the third.

B360 Maroondah Highway (~51km)

- From Narbethong
- Alexandra

This highway connects metropolitan Melbourne to Alexandra via Healesville, the Black Spur.



Figure 198 B360 Maroondah Highway between Narbethong and Alexandra (Google)

Based on public coverage maps:

- Telstra shows continuous 4GX outdoor coverage across the route
- Optus shows 4G continuous coverage across the route, with new coverage under construction around Acheron and Alexandra
- Vodafone shows no coverage between Narbethong and Buxton, with consistent 4G coverage as far as Alexandra.



Figure 199 Telstra coverage on B360 Maroondah Highway



Figure 200 Optus coverage on B360 Maroondah Highway



Figure 201 Vodafone coverage on B360 Maroondah Highway

Based on public coverage maps, there appears to be only 4G coverage by at least two mobile providers over the entire route.

B300 Melba Highway (~40km)

- From near Kinglake Central
- To Yea

This highway connects the Healesville-Kinglake Road near Kinglake to Yea.



Figure 202 B300 Melba Highway between Healesville-Kinglake Rd and Yea (Google)

Based on public coverage maps:

- Telstra shows continuous 4GX and 3G outdoor coverage
- Optus shows some poor coverage near between Castella and Glenburn, but otherwise shows continuous 4G outdoor coverage
- Vodafone shows no coverage, with some 3G coverage around Yea.



Figure 203 Telstra coverage on B300 Melba Highway



Figure 204 Optus coverage on B300 Melba Highway



Figure 205 Vodafone coverage on B300 Melba Highway

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

A300 Midland Highway (~121km)

- From Girgarre East
- To Nalinga



Figure 206 A300 Midland Highway between Girgarre East and Nalinga (Google)

Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* coverage across the entire route
- Optus shows continuous 4G *outdoor* coverage across the entire route
- Vodafone shows continuous 4G *outdoor* coverage or better across the entire route.







Figure 208 Optus coverage on A300 Midland Highway



Figure 209 Vodafone coverage on A300 Midland Highway

Based on public coverage maps, there appears to be 4G coverage by all three mobile providers over the entire route.

B400 Murray Valley Highway (~130km)

- From Wyuna East
- To Esmond

This section of highway connects the Murray Valley townships of Cobram and Yarrawonga and exits the Moira LGA near Bundalong/Esmond.



Figure 210 B400 Murray Valley Highway (Google)

- Telstra shows continuous 4GX coverage across the entire route
- Optus shows 4G outdoor coverage across the majority of the route, except for poor 3G handheld and external antenna coverage in the area from Cobram East to Birramine
- Vodafone shows 4G and 3G outdoor coverage across the entire route







Figure 212 Optus coverage on the section of the B400 Murray Valley Highway



Figure 213 Vodafone coverage on the section of the B400 Murray Valley Highway

In summary, there appears to be continuous 4G coverage by all three mobile carriers.

B75 Northern Highway (~59km)

From Wallan

• To near Heathcote

This section of highway connects the Hume Freeway at Wallan to service the townships and road network in between the Calder and Hume Freeways.



Figure 214 B75 Northern Highway between Eildon and Yark (Google)

- Telstra shows continuous 4GX and 3G *outdoor* coverage across the entire route
- Optus shows continuous 4G coverage across the route, with new 4G Plus upgrades under construction near Heathcote
- Vodafone shows continuous 4G *outdoor* coverage or better for most of the route, except there is no coverage between Pyalong and Heathcote.


Figure 215 Telstra coverage on the section of the B75 Northern Highway



Figure 216 Optus coverage on the section of the B75 Northern Highway



Figure 217 Vodafone coverage on the section of the B75 Northern Highway

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

6.4 C-Grade Roads

There are 27 declared C roads in the region forming a mesh between major and small communities. In general, there is good highway coverage across the region, however mountainous regions and national park land present very low population density and infrastructure challenges for all mobile carriers and consequently unreliable service for 000 emergency calls in those areas.

6.5 Rail

Melbourne – Seymour

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-Seymour route have continuous 4G mobile coverage from all three MNOs by the end of the 2018 calendar year.

Melbourne – Albury/Wodonga

For passengers travelling on the Standard Guage rail line between Melbourne and Albury, the route carries up to 6 services per weekday between Melbourne and Albury. Annual patronage for 2017-18 was 88,000 - a 6% decrease on 2016-17.

The route is served by VLine diesel-hauled rolling stock and XPT trains from Sydney and therefore 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.

As the rail primarily basically follows the Hume Highway, trackside coverage for all three mobile carriers is predictably continuous and of good quality.



Figure 218 Telstra rail coverage between Melbourne and Albury



Figure 219 Optus rail coverage between Melbourne and Albury



Figure 220 Vodafone rail coverage between Melbourne and Albury

In summary, there appear to be no mobile coverage issues on the route, with the three major mobile network operators all offering near-continuous 4G service, 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.



A. Acknowledgements & Qualifications

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.

- 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 July 2018 during which this report was prepared.
- Data by Region¹⁹ providing statistics at the level of Local Government Area (LGA)
- Quickstats²⁰ 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.
- 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"

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- 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".
- 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".
- 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".
- For any screen capture of Sigfox coverage that does not show an acknowledgement of the data source, the following acknowledgement applies: "Leaflet".

Qualifications

- The ABS periodically makes corrections to its data (including the 2016 Census data utilised widely in this report), so minor discrepancies may be noted 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

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"

²⁰ See for example

http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/UCL211002?opendocument

¹⁹ See <u>http://stat.abs.gov.au/itt/r.jsp?databyregion</u>

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.

 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" iPhone 6.

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. 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 mobile blackspots
- 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 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 Victoria residents and businesses and their capital city counterparts – the gap 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 221 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

Digital 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).²¹

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),

²¹ 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.²² Free public WiFi is typically provided by local governments for, disadvantaged citizens, the wider public and visitors in larger cities and towns.²³ 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.²⁴

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

²² 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

²³ 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.

²⁴ 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 qualityadjusted basis

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 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.²⁵

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.



²⁵ Involving the Department of Education and Training.

