

Regional Digital Plan Supporting Information

BARWON

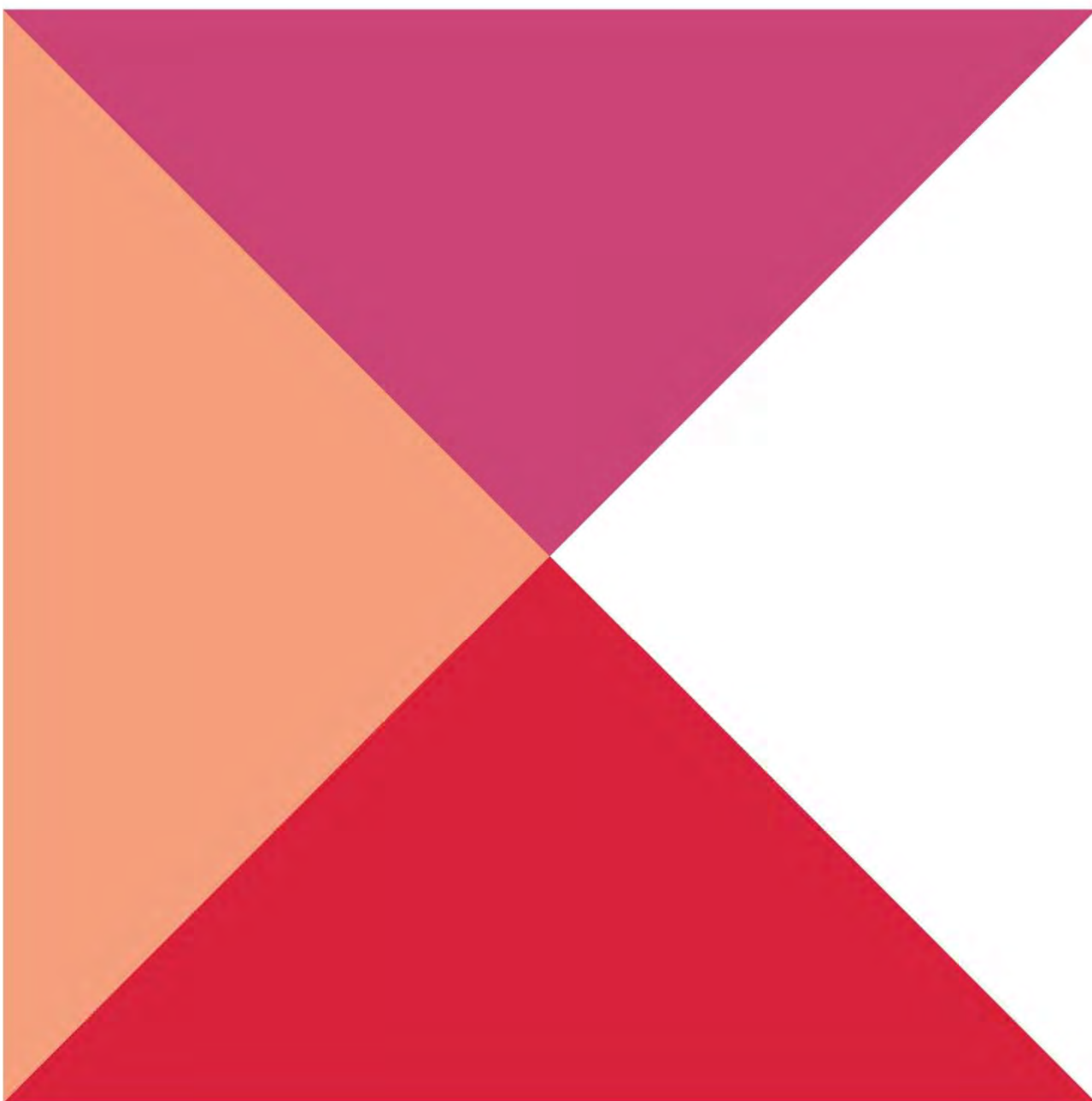


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Context of the Digital Plan

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

This document presents the detailed evidence base and background supporting information that has informed the development of the Barwon Regional Digital Plan.

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

Why are Digital Plans needed?

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

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

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

- *Households* around the world rely more and more on digitally-based communications, entertainment and shopping, banking, news and other personal services
- *Communities* increasingly stay connected and safe, and community services are delivered more effectively, through digital platforms
- *Businesses* of all sizes rely on digital advances – high bandwidth fixed and mobile communications, data capture and analysis, artificial intelligence and digitally-driven production techniques – to increase productivity and remain competitive.

How will the Digital Plans be used?

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

This Digital Plan will be:

- Used by the Regional Partnership as the basis for its actions and advocacy on digital issues, particularly in communicating the recommendations of this Plan to relevant stakeholder groups for their consideration, action and response
- Shared with local, state and Commonwealth governments to raise awareness of the digital issues affecting the region and assist in their own advocacy, policy and program development
- Shared with industry and local businesses to encourage them to identify and target investment to areas of highest need across the region
- Made available publicly for interested community members, households and businesses in the region and for other organisations keen to utilise this research and analysis for their own advocacy and activities.

How were the Digital Plans prepared?

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

- Extensive face-to-face consultation with the Regional Partnerships and Digital Plan Working Groups

- In-depth interrogation of the State Level Information Management (SLIM) database¹
- Fieldwork comprising an online survey of all local governments in regional Victoria, and face-to-face interviews in each region
- Independent expert advice on the fundamental drivers of unmet needs and potential solutions
- Confirmation from each Regional Partnership that the Digital Plan hits the mark as a tool for them and their stakeholders in driving place-based solutions to unmet digital needs.

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

SECTION 1 – Detailed Issues Analysis

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

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

Summary

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

Table 1 Summary of common unmet needs for different regional user groups

Place/sector (typology)	Demand characteristics (place/user)	Digital ‘unmet needs’
Significant places		
<i>Businesses</i>	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
<i>Households</i>	High-medium population densities, suitable for NBN fixed line services	Access to affordable, high-capacity broadband Improved digital skills
<i>Communities</i>	Varying digital literacy & ability to afford broadband	Access to affordable broadband (including public WiFi) Increased digital skills
Primary production areas		
<i>Farming</i>	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		
<i>Permanent attractions</i>	Both town & remote locations Visitors with high digital literacy & dependence (e.g. TripAdvisor, GPS, Facebook)	Mobile coverage Public WiFi – general and site-specific High bandwidth fixed broadband for WiFi backhaul
<i>Events</i>	Highly seasonal/periodic	Temporary mobile peak capacity requirements High-bandwidth fixed broadband for WiFi backhaul
Transport corridors		
<i>Road</i>	Motorists & freight Mix of major (VicRoads) & minor (local council) roads	Continuous mobile coverage
<i>Rail</i>	Passengers Increased need for high quality mobile 4G (5G) connectivity	In-carriage reception on rail services between Bendigo and Swan Hill

Fixed Connectivity

Available fixed broadband connectivity does not meet the needs of many businesses across the Barwon region due to technology limitations – the predominance of NBN FTTN in cities and towns will limit uniform access to effective NBN business-grade services when these are released due to the technical limitations of this service. In smaller localities, on the fringe of larger centres and in rural and remote areas, broadband for businesses is further compromised by fixed wireless and satellite technologies.

The fixed broadband needs of households in larger population centres are generally met at present, but the needs of households in smaller localities (less than 500 residents), on the fringe of larger centres and in rural and remote areas are compromised by having access only to NBN fixed wireless and satellite technologies. The high-level picture for households and businesses in primary production areas and at more isolated tourist sites is also of concern, with below par fixed connectivity for farm offices and homesteads and tourist site operators.

Mobile Connectivity

Mobile coverage generally appears to be good in Barwon cities, towns and localities down to 500 residents, and on significant roads and rail links based on analysis of publicly available mobile coverage maps. However, we know from consistent feedback and concerns of regional users that mobile service continuity and quality in many locations is a real concern. Undertaking the mobile coverage analysis as part of this plan has highlighted the lack of high-resolution coverage maps from MNOs which show real-world performance (i.e. where coverage is capable of supporting only voice services or more data-intensive activities as well such as web-browsing and mobile applications). This issue is elaborated on below and highlights the need for better data from MNOs to enable more informative analysis and identification of priority mobile blackspots in future iterations of this digital plan.

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

IoT Connectivity

Narrowband IoT networks are also relatively good across the primary production areas and food and fibre processing facilities analysed. While demand for these networks is currently moderate to low, demand is expected to grow significantly over the next 3-5 years as industries continue to digitise and seek to adopt next-generation business practices.

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

General Infrastructure and Technology Issues

Mobile network coverage

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

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

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

in the home and at work for a significant share of users. However, the publicly available coverage maps fail to distinguish between traditional voice and other narrowband services on the one hand, and high quality mobile broadband access on the other – that is, they do not provide enough information for regional users in particular to identify locations where higher bandwidth services will (and will not) work well.

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

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

The Victorian Government understands user disappointment and disillusionment with mobile connectivity in regional areas and has joined industry stakeholders in calling for MNOs 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 MNOs to publish more useful coverage data and supports the ACCC in its public commitment to take regulatory action if cooperative progress is not made.

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

The Digital Divide – looking below the surface

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

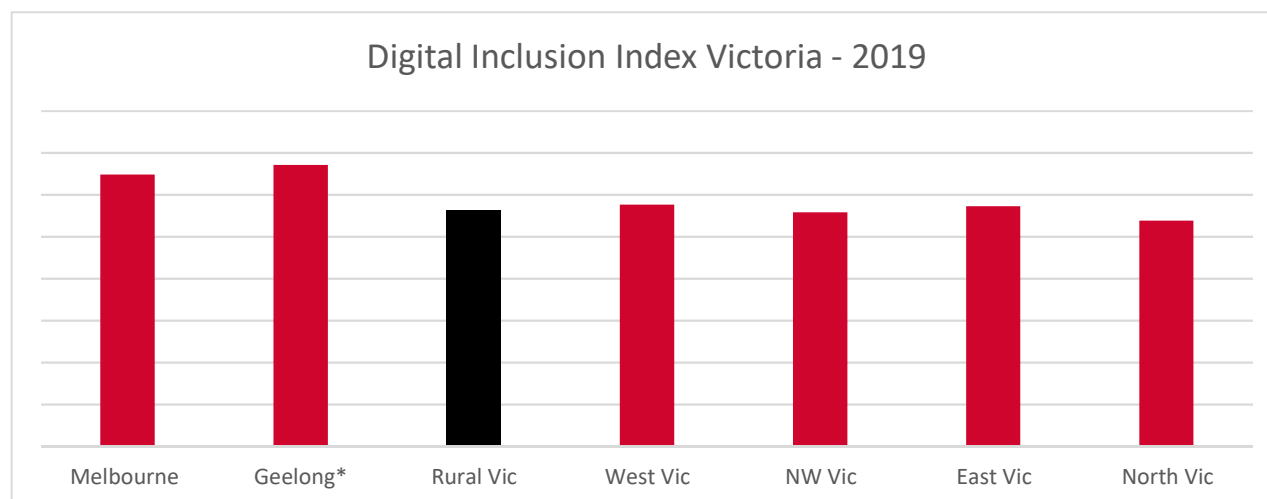


Figure 1 Summary of 2019 RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) findings across Victorian regions

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

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

Where NBN infrastructure cuts over from fixed line to fixed wireless technology, or from fibre to the premise (FTTP) to fibre to the node (FTTN) within fixed line areas, businesses and homes on either side of the technology boundary will experience different service quality. Similarly, local topology and antenna settings can result in substantial quality disparities in and between localities.

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

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

Business-grade broadband services - NBN

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

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

Competing fixed broadband networks

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

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

Common technology issues

In developing the Digital Plans, numerous digital technology issues were identified through Regional Partnership and stakeholder consultation and expert analysis. Understanding the nature of these issues and the barriers which must be overcome is the first step towards addressing them and their impact on the digital divide. This

section provides deeper insights into these problems arranged under six common themes that are most relevant to Victoria's regions:

1. **Fixed broadband**, in particular, the national broadband network (NBN)
2. **Mobile network coverage** – for both voice and data services. For some, this is an alternative to fixed broadband connectivity. For many, the “untethered” access made possible by the mobile networks is vital to social amenity, safety and productivity.
3. **Public WiFi** availability, particularly in low income locations
4. **Low-powered wide area network (LP-WAN) coverage** and uptake for Internet of Things (IoT) applications. Embracing the application of IoT technologies is important if Australia is to achieve “best practice” in areas such as agriculture, community infrastructure and the like.
5. The potential to enhance outcomes by access to **Government infrastructure** – such as the optical fibre deployed along rail routes, and towers used for radio networks.
6. **Digital skills** – a vital counterpart to the availability of infrastructure and services.

1. Fixed Broadband

NBN Rollout Schedule concerns

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

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

Affordability and service quality concerns

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

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

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

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

CVC Capacity

The under provisioning of CVC capacity is not due to technical limitations, but rather to a pricing model designed to boost NBN Co's wholesale revenues. In the early life of the NBN, RSPs typically acquired an *average* of just over 1 Mbps per customer (supporting users with connection speeds up to 100/40 Mbps). More recently, NBN Co has introduced pricing incentives to promote the purchase of additional CVC capacity, and at the time of this report, the average had risen to a little over 1.5 Mbps. Nevertheless, congestion can still occur during peak periods.

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

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

Backhaul Pricing concerns

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

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

Concerns raised around limitations of NBN technologies

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

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

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

Satellite concerns

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

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

Fixed Wireless concerns

NBN Co utilises fixed wireless (FW) to a maximum distance of 14 kilometres from the base station. Installations at the limits of this reach may experience some variability in signal quality. The current maximum speed is 50/20 Mbps. NBN Co had signalled its goal of introducing a 100/40 Mbps offering, but no recent announcements have been made as to if and when this will become available.

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

Fibre to the Node (FTTN) concerns

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

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

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

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

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

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

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

NBN Connection and Fault Repair Experience

The parliamentary Joint Standing Committee on the NBN released its first report on 29 September 2017. The Committee recommended that appropriate consumer protections be established for broadband services,

including service connection and fault repair timeframes, minimum network performance and reliability, and compensation arrangement when required standards were not met.

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

Alternatives to NBN Connections

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

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

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

2. Mobile blackspots

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

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

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

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

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

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

With large geographic areas of Victoria destined to be limited to satellite for fixed broadband services, the mobile networks can provide a valuable adjunct, fallback or alternative to fixed broadband – providing low latency

connections and providing a “safety net” when satellite services are affected by solar interference or severe weather conditions.

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

- significant places (population centres and tourist locations)
- road and rail transport routes
- areas of agriculture or other areas of intensive economic activity.

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

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

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

Rail coverage

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

Disparate coverage

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

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

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

Major events capacity shortfalls

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

Potential approaches to alleviate problems with capacity shortfalls include:

- Coverage Augmentation. This may be applicable to venues that are regularly used, and which warrant a permanent boost in capacity through the deployment of micro-cells.
- WiFi Coverage. Providing a public WiFi zone covering the area in which the event is conducted may allow a proportion of the demand (notably for data) to be offloaded from the mobile networks, freeing more capacity for voice communications.

- Demand Aggregation. Compiling a consolidated State-wide schedule of all events where additional mobile capacity is needed could underpin a procurement process from the MNOs to satisfy the requirements.

3. Public WiFi

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

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

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

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

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

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

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

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

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

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

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

5. Alternative infrastructure

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

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

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

6. Digital skills

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

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

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

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

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

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

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

- cannot afford either fixed or mobile connectivity
- live outside mobile coverage areas

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

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

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

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

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

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

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

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.²

SUPPLY

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

Rated **High** where:

- Two or more 4G networks are available

Rated **Medium** where:

- Only one 4G network is available

Rated **Low** where:

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

DEMAND

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

Narrowband (LP-WAN) IoT access rating methodology³

SUPPLY

The present supply of LP-IoT is rated:

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

DEMAND

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

Public WiFi

SUPPLY

Supply of public WiFi is rated:

² 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

³ Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the plan analysis as this information was not publicly available at the time of analysis. High bandwidth and two-way IoT are provided by mobile MNOs.

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

DEMAND

Demand by residents is rated according to income levels (**High** where incomes are low), reflecting the importance of mobile access to everybody for everyday life.⁴

⁴ This broad measure could be improved by using more detailed information on disadvantageded locations from the ABS Socio-economic Index (SEIFA) and the Jesuit Social Services study *Dropping of the Edge: 2015* (postcode level)

Significant Places Analysis

Digital supply-demand balance for selected significant places 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.**

Table 2 Significant places: current unmet digital access needs.

Place	LGA	Name	User Type	Access			
				Fixed Supply / Demand	Mobile* Supply / Demand	LP-WAN IoT Supply / Demand	WiFi Supply / Demand
City	Geelong	Geelong (pop. 157,104)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	H/L
			Community	n.a.	H/H	n.a.	H/L
	Geelong	Ocean Grove / Barwon Heads (pop. 18,205)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
	Surf Coast	Torquay / Jan Juc (pop. 16,948)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
	Geelong	Lara (pop. 13,334)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
	Geelong	Drysdale / Clifton Springs (pop. 12,482)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Colac- Otway	Colac (pop. 11,891)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
	Geelong	Leopold (pop. 11,875)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
Town	Geelong	Portarlington / St Leonards (pop. 6,881)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/H
			Community	n.a.	H/H	n.a.	L/H
	Queenscliff	Pt Lonsdale / Queenscliff (pop. 3,751)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
	Surf Coast	Anglesea (pop. 2,538)	Business	M/H	H/H	H/M	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Surf Coast	Winchelsea (pop. 1,586)	Business	M/H	H/H	H/L	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
	Colac- Otway	Apollo Bay (pop. 1,366)	Business	M/H	H/H	H/L	n.a.
			Home	H/H	H/H	H/L	M/M
			Community	n.a.	H/H	n.a.	M/M
	Surf Coast	Aireys inlet / Fairhaven (pop. 1,116)	Business	M/H	H/H	H/L	n.a.
			Home	H/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L
	Surf Coast	Lorne (pop. 1,026)	Business	M/H	H/H	H/L	n.a.
			Home	H/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L

Local	Geelong	Batesford (pop. 764)	Home	M/H	H/H	H/L	L/L
			Community	n.a.	H/H	n.a.	L/L
	Colac-Otway	Birregurra (pop. 540)	Home	M/H	H/H	H/L	M/L
			Community	n.a.	H/H	n.a.	M/L

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

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

Commentary

Fixed access supply in Barwon cities and larger towns is currently favourable for households, but under par for businesses as the prevailing NBN FTTN technology will not uniformly support effective business-grade services and alternative NBN-equivalent broadband services are not available. The situation is less favourable for small towns and localities where NBN fixed wireless prevails such as Batesford and Birregurra. Mobile access generally appears to be good for the 16 Barwon places examined (recognising coverage issues at specific sites). Coverage of narrowband IoT networks across Barwon places is high and generally not constraining as demand is moderate to low at present. The supply of public WiFi is mixed across the region but given the relatively high incomes of population centres in the region does not present supply shortfalls for disadvantaged residents at this stage.

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

Fixed access

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

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

The Regional Partnership emphasises the importance of ensuring the education sector can access high-speed digital services. There is variability in the standard of services delivered across educational facilities and barriers impeding the attainment of higher quality services for some institutions and locations. This issue needs to be explored further to identify ways in which priority facilities can be identified and a model for enabling infrastructure upgrades developed.

Mobile access

Mobile access according to public coverage maps from MNOs appears to be good for all the Barwon cities, towns and localities examined (down to 500 residents) with near-complete 4G coverage by at least two MNOs (recognising there will be specific sites which experience unsatisfactory mobile performance). The light green shading for mobile coverage analysis in the heat map tables in these sections reflect the concerns regarding the veracity of these conclusions based on the best-available publicly data used.

However, the 3-5 year outlook is uncertain, as only the larger population centres may receive forthcoming 5G rollouts in the near term (based on MNOs 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, but also poses the potential of leaving some towns and localities further behind their peers in larger population centres.

Narrowband (LP-WAN) IoT⁵

Coverage of narrowband IoT networks across Barwon cities, towns and localities is currently sufficient as demand by businesses, local governments and households is low with little apparent unmet need at present.

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

Looking forward 3-5 years - It is expected some local governments will roll out public WiFi in public places, disadvantaged neighbourhoods and popular tourist locations and in response to their own “smart city” unmet needs. This suggests a potential role for targeted Commonwealth and Victorian Government programs – with the current CRCP free public WiFi trials in Shepparton and Geelong providing useful lessons on the design of such programs. However, falling mobile data prices, and scope for mobile networks to support low power Smart City sensors may mean public WiFi becomes less relevant for social and local government service delivery purposes. Monitoring of 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 Barwon region relative to Melbourne, and substantial differences between LGAs. Furthermore, at any location in the region, there will be individuals and businesses with low digital skills.

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

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

⁵ Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the plan analysis as this information is not publicly available.

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

Seasonal demand pressures

An important consideration regarding the adequacy of digital connectivity in the Barwon region relates to the demand pressures associated with seasonal influxes of visitors and tourists.

These demand pressures are relevant to any areas across regional Victoria where there may be large differences in the permanent population levels versus the temporary overnight populations that may occur during popular visitation times (e.g. during summer months, popular music festivals and other events).

These demand pressures are felt particularly strongly in popular coastal areas throughout summer months. In the case of Barwon, many of these places are located in the Surf Coast Shire and include places such as Torquay / Jan Juc, Anglesea, Lorne and Airey's Inlet. For example, based Peak Overnight Population data for Dec 2016 – Jan 2017, Lorne had a permanent population of 1,111 while its peak overnight population in that period was 15,271. This is more than a 13-fold increase in population and naturally introduces substantially larger demand on the local fixed-line, mobile and WiFi networks compared to quieter periods. Local government is well aware of stakeholder feedback on this issue and the impact these influxes have on the quality of local digital services for residents and visitors.

So, although a number of significant places and tourist locations (predominantly those located close to densely populated areas) appear to have good mobile coverage based on public coverage data, the 'lived experience' is often different, in part due to these significant seasonal influences. As such, the green ratings in the summary table above should be interpreted with caution. Places with substantial increases in population in certain periods may experience degraded service quality and reliability.

Primary Production Areas and Related Industry Analysis

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.**

Given the importance of the related food and fibre processing industry to the Barwon economy, a selection of facilities has also been included in the analysis to reveal any general patterns that may prevail.

Table 3 Primary production areas: current unmet digital access needs

	Land Use	Location	User Type	Access		
				Fixed Supply / Demand	Mobile* Supply / Demand	LP-WAN IoT Supply / Demand
Primary Production Areas	Dairy grazing	South-west of Colac	Business	L/H	M/H	H/M
			Home	M/H	M/H	H/L
	Beef grazing	North of Colac	Business	L/H	M/H	H/M
			Home	M/H	M/H	H/L
	Poultry	Around Winchelsea	Business	L/H	H/H	H/M
			Home	L/H	H/H	H/L
Food and Fibre Processing Facility	Winery	Drysdale	Business	L/H	H/H	H/M
			Home	M/H	H/H	H/L
	Dairy	North Geelong	Business	H/H	H/H	H/M
			Home	H/H	H/H	H/L
	Forestry & timber	Colac	Business	M/H	H/H	H/M
			Home	H/H	H/H	H/L

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

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

Commentary

The fixed broadband unmet needs picture for businesses in primary production areas is a concern with supply in all rated low and mobile access found to be an intermediate supply shortfall in two areas. Low power IoT supply-demand balance is in transition – supply is predominantly good, and relative to nascent demand (which is expected to rise substantially over the next 3-5 years) there are currently no supply shortfalls identified.

Food and fibre processing facilities vary across the region in terms of proximity to population centres, their production inputs and digital connectivity demands. Those located closer to large population centres tend to have access to higher quality fixed broadband and mobile connectivity.

Fixed access

Current situation - fixed access in the primary production areas across regional Victoria comprises a mix of NBN fixed wireless and satellite technologies, while for food and fibre processing facilities within or near towns there is higher quality FTTN or better infrastructure available. For Barwon, the landmass served by satellite is approximately 50%. Business and household demand are, however, uniformly high, meaning major unmet demand for fixed access across the primary production areas considered and for the winery included in the analysis located in Drysdale.

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

Mobile coverage

Current situation - Mobile coverage in primary production areas and at food and fibre related facilities of Barwon is mixed, with several locations having an intermediate supply shortfall with the others assessed as currently adequate, keeping in mind reservations about the accuracy of publicly available mobile coverage maps used for analysis.

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 but may be possible for processing facilities located within or close to processing facilities. Rising demand in the face of largely static supply will mean the unmet demand situation will worsen. Redesigned mobile blackspot programs will be needed to ameliorate this growing supply-demand gap.

Narrowband IoT

Current situation - Narrowband IoT coverage is currently good alongside low to medium demand across the Barwon primary production areas and processing facilities analysed.

Looking forward 3-5 years - demand for such coverage is expected to grow strongly. There may be a valid role for government market stimulation where more acute supply shortfalls become apparent or in supporting businesses to explore and adopt devices and technologies that can leverage the available networks.

Tourist Locations Analysis

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.**

Table 4 Tourist locations: current unmet needs

Type	Location	LGA	User Type	Access	
				Fixed Supply / Demand	Mobile* Supply / Demand
Permanent	Bells Beach	Surf Coast	Operator	M/H	H/H
			Visitor	n.a.	H/H
	Johanna Beach	Colac Otway	Operator	L/H	M/H
			Visitor	n.a.	M/H
	The Blues Train Queenscliff	Queenscliff	Operator	M/H	H/H
			Visitor	n.a.	H/H
	Marriner's Lookout	Colac Otway	Operator	L/H	H/H
			Visitor	n.a.	H/H
	Jirrahlinga Koala & Wildlife Sanctuary	Greater Geelong	Operator	L/H	H/H
			Visitor	n.a.	H/H
	Kardinia Park	Greater Geelong	Operator	H/H	H/H
			Visitor	n.a.	H/H
	Adventure Park	Greater Geelong	Operator	L/H	H/H
			Visitor	n.a.	H/H
	The Great Ocean Road	Surf Coast, Colac Otway	Operator	M/H	L/H
			Visitor	n.a.	L/H
Events	The Falls Music & Arts Festival	Surf Coast	Operator	L/H	M/H
			Visitor	n.a.	M/H
	Festival of Sails	Greater Geelong	Operator	M/H	H/H
			Visitor	n.a.	H/H
	Portarlington Mussel Festival	Greater Geelong	Operator	M/H	H/H
			Visitor	n.a.	H/H
	Gellibrand River Blues & Blueberry Festival	Colac Otway	Operator	L/H	M/H
			Visitor	n.a.	M/H
Trails	The Great Ocean Walk	Surf Coast	Operator	M/H	L/H
			Visitor	n.a.	L/H
	Surf Coast Walk	Surf Coast	Operator	M/H	M/H
			Visitor	n.a.	M/H
	Bellarine Rail Trail	Greater Geelong, Queenscliff	Operator	M/H	H/H
			Visitor	n.a.	H/H
	Maits Rest Rainforest Walk	Colac Otway	Operator	L/H	L/H
			Visitor	n.a.	L/H
	Forrest Mountain Bike Trail	Colac Otway	Operator	L/H	L/H
			Visitor	n.a.	L/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 broadband is required for site operators to provide WiFi services to visitors and for the day-to-day conduct of the business, and mobile access is needed 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 frequently visited by locals and tourists.

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

The Great Ocean Road region represents a high priority for digital connectivity in the region, with high annual visitation and the potential to generate greater economic returns from visitors. High quality, continuous connectivity along this road link is critical to underpin the continuing development of this tourist region and meet growing visitor connectivity expectations and enable business innovation and engagement with visitors.

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

Digital supply-demand balance for selected transport corridors 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.

Table 5 Transport corridors: current unmet needs

Road Class	ID	From	To	Comment	Mobile* Supply / Demand
Motorways	M1	Cocoroc	Waurm Ponds	Continuous 4G coverage by three MNOs	H/H
A/B	A1	Waurm Ponds	Pirron Yallock	Continuous 4G coverage by three MNOs	H/H
	A10	Waurm Ponds	Corio	Continuous 4G coverage by three MNOs	H/H
	A300	Geelong	Batesford	Continuous 4G coverage by three MNOs	H/H
	B100	Torquay	Yuulong	Unreliable service by all three MNOs	L/H
	B100	South Geelong	Torquay	Continuous 4G coverage by three MNOs	H/H
	B110	South Geelong	Queenscliff	Continuous 4G coverage by three MNOs	H/H
C	All	43 roads		Low/no coverage in parkland and coastal terrain	L/H
Rail		Melbourne	Geelong	4G coverage by three MNOs	H/H
		Geelong	Warrnambool	4G coverage by two MNOs	H/H

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

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

Table 5 summarises the limited analysis of mobile coverage supply and demand on major and more minor roads and rail links in Barwon, conducted to demonstrate the place-and-sector approach for transport corridors and note any preliminary patterns.

Commentary

The pattern from the sample of major and minor roads is reasonable mobile coverage on major (Class A) thoroughfares and significant (Class B) roads, with generally poor coverage on minor (Class C) roads, again noting the limitations of the data available to provide a complete picture of service quality and continuity along roads that appear to be well served. However, examination of more roads and rail links is required to confirm these unsurprising patterns.

Looking forward 3-5 years, this tentative pattern is expected to continue, with intervention required to lift mobile coverage on more minor roads in the absence of market forces that will drive improvements on their own.

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

Glossary

ABS: Australian Bureau of Statistics

ACCC: Australian Competition and Consumer Commission

Cat-M1: Narrowband IoT technology

CPCP: 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 – Supporting Evidence Base

1 Barwon General Characteristics

Barwon population centres, primary production areas, tourist sites and transport corridors



Figure 2 Barwon population centres, primary production areas, tourist sites and transport corridors

1.1 The Land and the People

Population density differs widely across the region – 196 residents per square kilometre for Geelong LGA, six for Colac Otway. Over half the region's population lives in Geelong, with a further 20 per cent in the other cities, towns and localities. The remaining 30 per cent live on the fringe of these centres and in rural and remote locations, and reflecting their greater dispersion, experience less favourable digital connectivity than their more urbanised peers.

Farming in the region includes dairy south-west of Colac, beef grazing north of Colac and poultry around Winchelsea.

Tourist sites include year-round attractions, coastal towns where populations swell during summer holiday periods 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 supply-demand analysis.

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

Key features are:

- South-west of and adjoining Greater Melbourne
- Approximately 6,000 kilometres squared (very small relative to other regions)
- Population 300,000 (2017) – population density 48 residents per kilometres squared (very high for regional Victoria)
- Four local government areas (LGAs) – Greater Geelong (population 240,000), Surf Coast (31,000), Colac-Otway (21,000) and Queenscliff (3,000)
- Main cities and towns: Geelong (157,000, over half of the region’s population), Ocean Grove/Barwon Heads (18,000), Torquay/Jan Juc (17,000), Lara (13,000), Drysdale/Clifton Springs (12,000), Colac (12,000), Leopold (12,000) – typical structure of a 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: 38% of the population have post-secondary qualifications – higher than regional average (34%)
- Unemployment: 5.9% total, 11.9% youth – close to regional average (5.9% total, 11.5% youth)
- Digital inclusion: mid-ranked on the RMIT-Swinburne-Telstra Digital Inclusion Index⁶

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

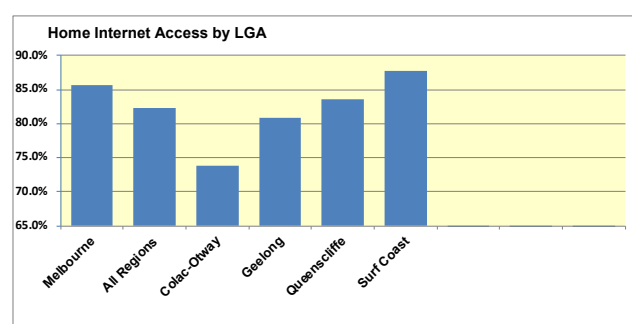
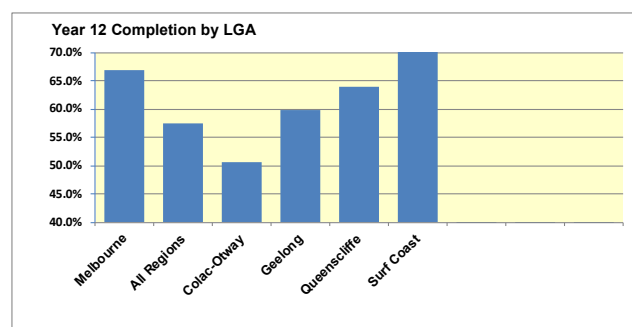
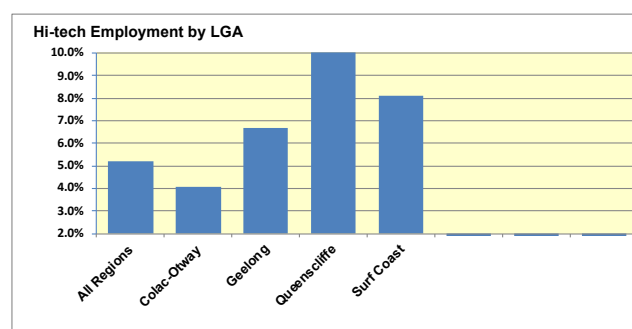
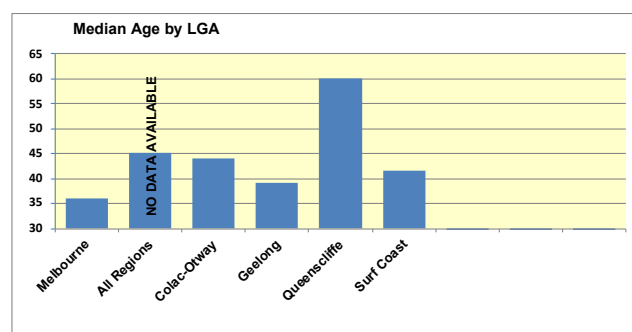


Figure 3 Comparisons of Barwon indicators of digital infrastructure demand

⁶ Measuring Australia’s Digital Divide – the Australian Digital Inclusion Index 2017

Notably, the residents of Colac-Otway 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) \$15.1 billion (high)⁷, with relatively strong growth over the past 10 years (1.6% p.a., in line with population growth) compared to 0.5% p.a. for total regional Victoria.

Eight industries make up three quarters of Barwon employment:

- Health care and social assistance (15%)
- Retail trade (11%)
- Construction 10%)
- Education and training (10%)
- Manufacturing (8%)
- Accommodation and food services (tourism) (8%)
- Public administration and safety (6%)
- Professional, scientific and technical services (6%).

Barwon residents are employed across occupational categories as follows:

- Professional (21% of residents), technical & trades (15%), managers (12%)
- Clerical & administration (12%), Community & personal services (13%)
- Labourers (11%), sales (10%), machinery operators & drivers (6%)

1.4 Structural Change

Three of the top employment industries (health, education and construction) have grown strongly over the past ten years and are forecast to continue to do so. Conversely, employment in two industries making

up fewer jobs (manufacturing and agriculture) has fallen over the past decade and is forecast to contract or grow only slowly over the next five years. This suggests the more important industries to embrace digital opportunities are health, education and construction – to step up to a higher level of digital intensity over the next five years to ensure best practice efficiency and competitiveness.

However, a somewhat different picture emerges when GRP contribution is considered. From this perspective manufacturing and construction are amongst the leading sectors, suggesting that manufacturing also warrants particular attention to its digital enablement. Despite manufacturing declining over the last ten years, it is still expected to be a key industry in the next five years even as other industries such as health continue to display strong growth.

Analysis of the digital intensity requirements of the eight industries supporting 74 percent of the Barwon workforce reveals that five of the industries will rely more heavily on digital services over the next 3 - 5 years. Three of the industries will move from having a low reliance on digital services to relying heavily on digital services. These include health and social assistance, tourism and agriculture/forestry. To ensure service improvements and productivity gains are achieved for these industries, addressing the increasing digital needs of these and other industries is important.

Another interesting example worth considering in the context of emerging industry needs is the location of the Australian Automotive Research Centre in Wensleydale. A key pillar of activity at this facility is autonomous vehicle testing. As this activity progresses the need for high quality digital connectivity will be increasingly important, as well as to support such vehicles and technology across the region. Based on public coverage data, the Centre only has access to NBN satellite services at this time.

Digital connectivity can be an important enabler of future industry applications and economic activity across the regions.

⁷ NIEIR (December 2018), Market Prices, Headline GRP with Indirect Taxes

1.5 General Characteristics Informing Digital Planning

This summary of the Barwon 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.

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

LGA	Area (km2)	NBN Technology (% Area)	
		Fixed Wireless (FW)	Satellite (SAT)
Colac-Otway	3,447	18%	81%
Greater Geelong	1,253	19%	67%
Queenscliff	9	10%	10%
Surf Coast	1,558	19%	79%
Region (km2)	6,267	1,156	4,876

Coverage of Businesses

Across the Barwon region, there are 5,882 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.

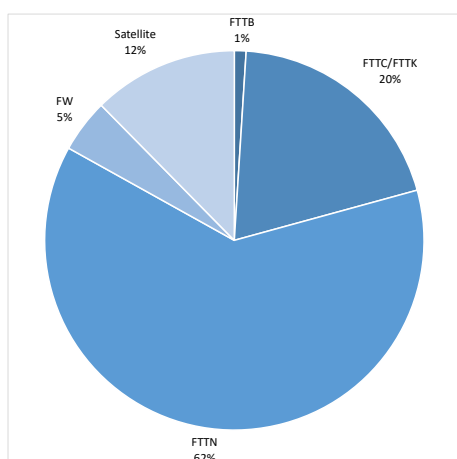


Figure 5 Businesses served by different NBN technologies

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

LGA	No. Bus.	Approximate Coverage (%)				
		FTTP	FTTB FTTC	FTTN	FW	SAT
Colac-Otway	851	1%	0%	64%	16%	18%
Greater Geelong	7,121	0%	26%	61%	2%	9%
Queenscliff	165	0%	0%	100%	0%	0%
Surf Coast	1,080	1%	0%	66%	11%	22%
Region (no.)	9,217	32	1,905	5,801	417	1,062

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 GNAF⁸ addresses (*see important qualification in footnote*) that lie within residential-zoned areas.

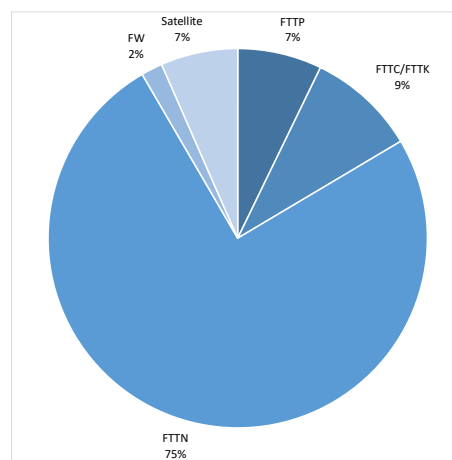


Figure 6 GNAF addresses served by different NBN technologies

LGA	No. Res.	Approximate Coverage (%)				
		FTTP	FTTB FTTC	FTTN	FW	SAT
Colac-Otway	8,895	3%	0%	87%	6%	5%
Greater Geelong	135,893	8%	11%	73%	2%	5%
Queenscliff	3,184	0%	0%	100%	0%	0%

⁸ 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.

Surf Coast	19,775	5%	0%	86%	2%	8%
Region (no.)	167,747	12,058	15,560	127,598	3,068	9,463

Whilst NBN Co's satellite solution is intended to service the most remote 3 per cent of the population, a very much higher proportion will be reliant on it in the Surf Coast LGAs. The overall percentage (7 per cent) is also higher than the national average and could possibly be higher if the additional dwellings in farming areas were to be included.

2.2 Mobile Coverage

Public Coverage Maps

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

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

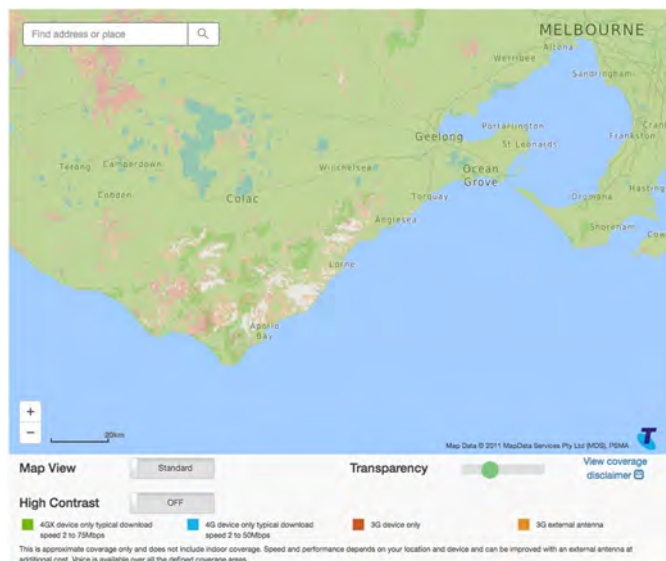


Figure 7 Telstra Public Coverage Map of Barwon Region

Telstra's public coverage map indicates good coverage with:

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

By simple visual examination of this map, Telstra appears to support coverage over at least 90% of the region.

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

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

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

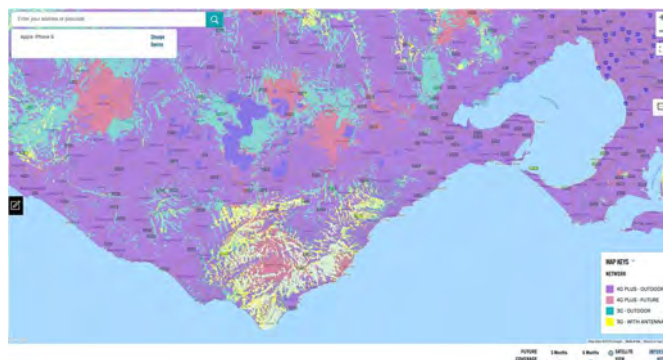


Figure 8 Optus Public Coverage Map of Barwon Region

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 iPhone 6 has been assumed.

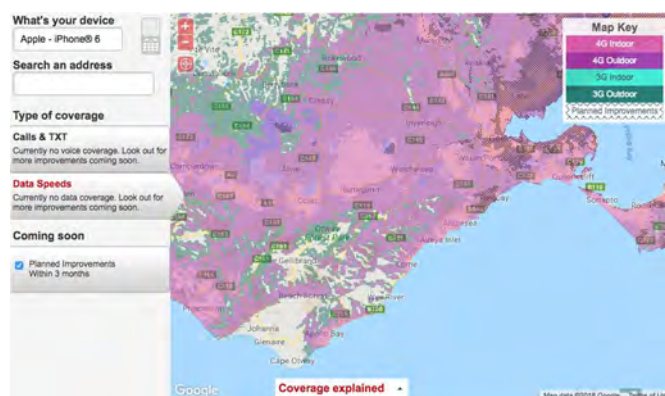


Figure 9 Vodafone Public Coverage Map of Barwon Region

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

- 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 MNOs do not always accord with end-user experience, a fundamental issue being they are based on outdoor connectivity. A range of applications have been developed to capture users' real-world experiences and integrate these into databases.

An example is the OpenSignal⁹ 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 mobile blackspots – but are less useful in assessing wide area coverage because of the difficulties of testing everywhere.

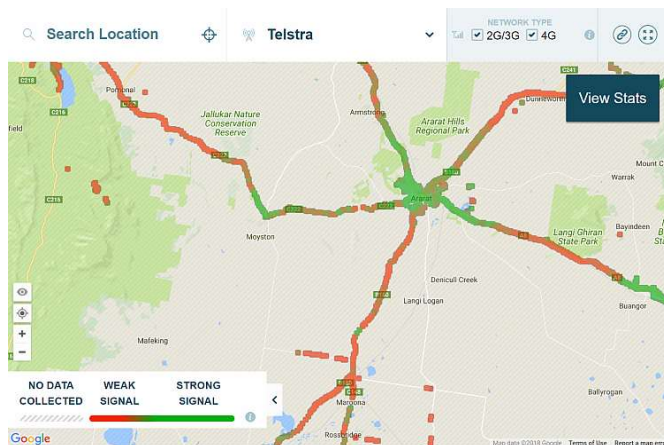


Figure 10 OpenSignal Mapping of Coverage around Ararat

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

General Notes

Coverage is constantly evolving as a result of ongoing MNO investment in new base stations - including new base stations supported by the Commonwealth Mobile

Black Spot Programs (MBSP) and the Victorian Governments Blackspot 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. *In all cases*, the outlook 5 years hence depends significantly on the pace and extent to which 5G technology is rolled out in regional areas of Victoria.

The mobile network operators are progressively introducing support for the Cat-M1 and NB-IoT protocols – suited to various IoT purposes. To date, only Optus has provided information for inclusion in SLIM. The Optus coverage relates to agricultural IoT trials being conducted in the north of the state and in 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 address a growing divide between urban and rural areas. In urban areas, high population densities and concentrated consumer spending attract network investment and competition. In addition, Telstra was required to grant other MNOs 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 has 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

⁹ See <https://opensignal.com/networks>, accessed on 10 July 2018.

percentage in Victoria is significantly higher – estimated at around 75 per cent - as a consequence of comparatively high population densities.

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

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

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

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

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

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

2.3 LP-WAN Coverage

General Notes

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

The original providers of LP-WAN technology coverage are:

- NNNCo, with LoRaWAN technology; LoRa is a two-way protocol; at the time of analysis, no information about coverage was 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 follow.

The major mobile network operators are rapidly moving into the provision of LP-WAN services (NB-IoT), with data available for digital plan analysis on Optus NB-IoT coverage. Telstra's LTE-M (LTE Cat-M1) public coverage map shows full coverage for Victoria except for some alpine areas.

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.

Given the low bandwidth utilised by these technologies, much less infrastructure investment is required to provide coverage to large areas.

LoRa

An Australian company, NNNCo Pty. Ltd., is a leading proponent of 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 map¹⁰. The diagram below shows coverage in the Barwon 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 11 Sigfox Coverage of Barwon Region

Based on this map, there may be some coverage around the northern and western parts of the Barwon Region.

Taggle

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



Figure 12 Taggle Coverage of the Barwon Region (SLIM)

2.4 Other Connectivity Options

The Victorian Government agency VicTrack has fibre links running along regional rail corridors. 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.

¹⁰ Map derived from Sigfox coverage map published at <http://www.sigfox.com/en/coverage> (accessed on 3 July 2018).

2.5 SLIM Analysis

Whilst several 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 16 places selected for analysis in this section include all cities (population¹¹ > 10, 000), all towns (population > 1,000) and the largest locality (population <1000) in each LGA that makes up the region.

In combination, the 16 places accommodate 87.2% of the region's population of 300,492. 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 five localities with populations of between 185 and 1,000 - in combination representing another 0.7% of the population in the region.

The balance of the region's population (12.0%) 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 ABS¹², this equates to an estimated 13,918 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 Geelong

Geelong is a city south-west of Melbourne. Lining its bay, The Waterfront esplanade has a 19th-century carousel, plus a curved art deco boardwalk and sea bath at Eastern Beach. Scattered along The Waterfront are the Baywalk Bollards, colourful sculptures chronicling city history. The Geelong Botanic Gardens lie at the eastern end of the bay. The central National Wool Museum hosts changing exhibitions.

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

- The population of Geelong grew by 14.5% over a decade to 157,104 in 2016, below the median of 18.7% for major population centres analysed in the region
- 75,341 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 53.2% being in full-time employment and 34.5% in part-time employment (with the remainder not at work at the time of the 2016 census)
- 10.2% of the labour force classified themselves as managers, 21.5% as professionals and 12.0% as clerical and administrative workers
- 5.7% of the labour force cited their industry of employment as hospitals (excluding psychiatric)
- Two public hospitals and four private hospitals are located in the city
- The city has 20 primary schools, six primary/secondary schools, seven secondary schools, one special development school and a university
- With a median age of 38, Geelong has one of the youngest populations in the region and just above the Victorian median of 37
- The ABS report a median annual household income of \$62.9K for Geelong, which is the median for major population centres analysed for the region but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 5,462 businesses in the city or its near surrounds
- In 79.3% of dwellings, at least one person accessed the internet from home.

¹¹ All population figures cited in this report are based on the 2016 Census, published by the Australian Bureau of Statistics.

¹² Much of the data for locations and larger areas is sourced from the ABS Quickstats site (see

http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/2?opendocument).

Skills

ABS Census data indicates:

- 28.5% 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
- another 14.0% have completed year 12.

ABS Industry employment data from 2016 indicated that the Geelong LGA had 6.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the city of Geelong 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that premises in Geelong, except some being serviced by FTTP, FTTN and fixed wireless, are yet to receive NBN services as most services are in construction or being planned.

Geelong will be largely serviced by NBN FTTN, FTTC with small pockets of FTTP and fixed wireless in areas surrounding the city. Many premises south-east and west of Geelong (Reedy Lake, Connewarra, Breamlea and Freshwater Creek) will be serviced by NBN fixed wireless with services in construction or being planned.

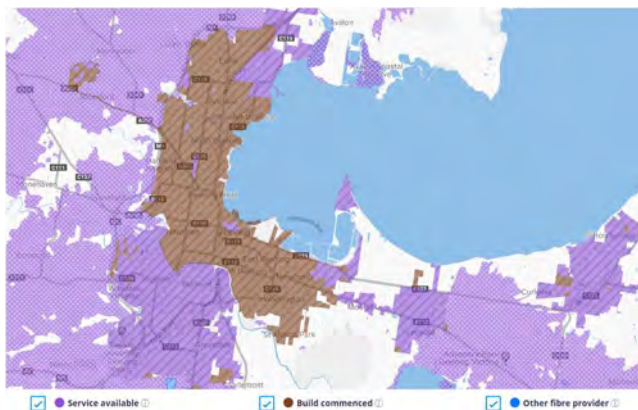


Figure 13 NBN Broadband Coverage of Geelong (NBN Co)

Our analysis shows that Central Geelong will be largely serviced by NBN FTTN and FTTC. NBN FTTB is in service at the Westfield building.

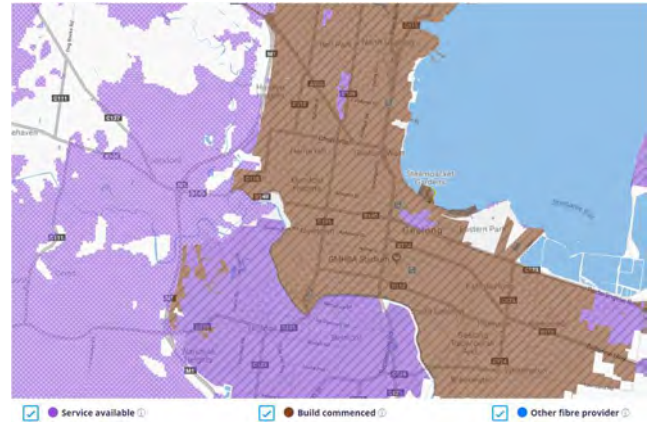


Figure 14 NBN fixed Broadband Coverage of Central Geelong (NBN Co)

Examining a satellite map shows a substantial number of premises north-east of Geelong that fall outside the fixed line area being serviced by fixed wireless.



Figure 15 Aerial imagery showing fixed line, fixed wireless and satellite areas in North-East Geelong (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 extensive Taggle and Sigfox coverage in Geelong.

Public WiFi Coverage

There are extensive free public WiFi zones in the Geelong CBD and waterfront, available 24 hours a day. The Connecting Regional Communities Program plans will extend and improve this coverage into North Geelong in 2019.

Geelong libraries have 24-hour free WiFi, including at the Geelong Library and Heritage Centre, Geelong West and Waurn Ponds.

Other

VicTrack fibre transits the northern fringe of the city, following the route of the train line. Utilising spare capacity on this fibre could enable high-speed connectivity to Melbourne.

No details are available of optical fibre connectivity provided by other MNOs.

Extensive 220v power is available in Geelong and its surrounding suburbs.



Figure 16 VicTrack fibre and Power transiting Geelong

3.2 City of Ocean Grove / Barwon Heads

Ocean Grove-Barwon Heads is a population centre on the Bellarine Peninsula, near Geelong. The Barwon Heads Bridge connects Ocean Grove and Barwon Heads. Fishing was the mainstay of the region in its early years. In the 1920s and 1930s the area became a popular holiday resort. The summer period today still sees a large influx of holidaymakers to the city.

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

- The population of Ocean Grove-Barwon Heads grew by 26.9% over a decade to 18,205 in 2016
- 8,793 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 51.9% being in full-time employment and 38.5% in part-time employment
- 12.9% of the labour force classified themselves as managers, 27.2% as professionals and 11.6% as clerical and administrative workers
- 5.9% of the labour force cited their industry of employment as hospitals (excluding psychiatric), and 2.6% cited local government administration
- There are no hospitals in the city but there are several located in nearby Geelong
- The city has four primary schools and a secondary school
- Ocean Grove-Barwon Heads has a median age of 42, equal to the median of the major population centres analysed for the region
- The ABS report a median annual household income of \$77.8K for Ocean Grove-Barwon Heads, one of the highest in the region and just below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 515 businesses in the city or its near surrounds
- In 87.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 39.1% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.8% have completed level III or IV trade certificates
- another 12.2% have completed year 12.

ABS Industry employment data from 2016 indicated that the Geelong LGA had 6.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the city of Ocean Grove-Barwon Heads 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Ocean Grove-Barwon Heads is largely serviced by NBN FTTN with small pockets of FTTP and fixed wireless in areas surrounding the city.

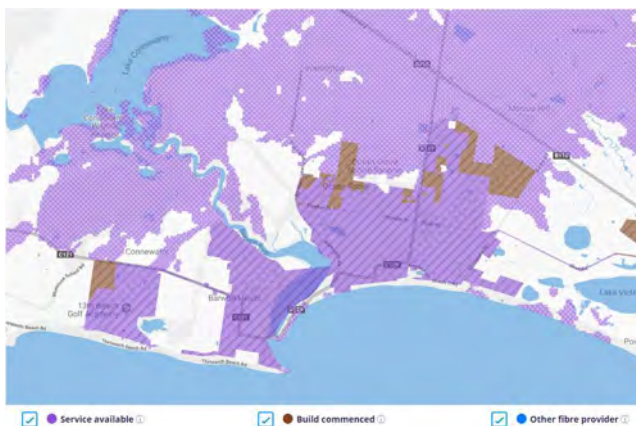


Figure 17 NBN Broadband Coverage of Ocean Grove-Barwon Heads (NBN Co)

Examining a satellite map of the same area shows a substantial number of premises north of Ocean Grove (Wallingford area) fall outside the fixed line area that are being serviced by fixed wireless.



Figure 18 Aerial imagery showing NBN fixed line and fixed wireless areas in north Ocean Grove (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 extensive Taggle and Sigfox coverage in Ocean Grove-Barwon Heads.

Public WiFi Coverage

Free WiFi access available the Barwon Heads and Ocean Grove Tourist Information Centres.

Access to free WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

Barwon Heads-Ocean Grove is neither on the VicTrack or the power transmission routes.

3.3 City of Torquay-Jan Juc

Torquay-Jan Juc is a coastal population centre at the east end of the Great Ocean Road coastal drive, south-west of Melbourne. It is well known for surf beaches like Bells Beach and Jan Juc Beach. The Surf Coast Walk trail starts at Point Impossible Beach and heads south-west via Point Danger Marine Sanctuary, with its limestone reef and sea slugs.

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

- The population of Torquay-Jan Juc was 16,948 in 2016. The statistical area of Torquay-Jan Juc is not available for the 2006 Census so the ten-year population growth rate cannot be provided for the area
- 8,469 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 54.8% being in full-time employment and 35.7% in part-time employment
- 15.0% of the labour force classified themselves as managers, 28.1% as professionals and 11.5% as clerical and administrative workers
- 4.5% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- There are no hospitals in the city but there are several located in Geelong north of the city
- The city has four primary schools and primary/secondary school
- With a median age of 39, Torquay-Jan Juc has one of the youngest populations in the region and just above the Victorian median of 37
- The ABS report a median annual household income of \$91.4K for Torquay-Jan Juc, one of the highest in Victoria and above Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 540 businesses in the city or its near surrounds
- In 89.8% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 41.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 16.3% have completed level III or IV trade certificates
- another 13.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Surf Coast LGA had 8.1% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the city of Torquay-Jan Juc 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Torquay-Jan Juc is largely serviced by NBN FTTN with small pockets of FTTP (mainly in the city's new developments) and fixed wireless is planned or under construction in areas surrounding the city.

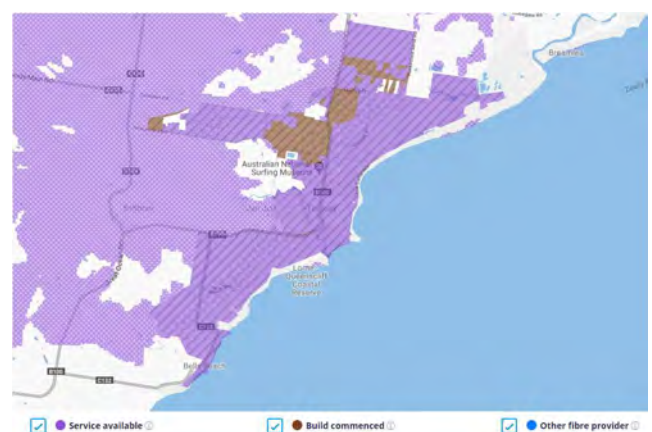


Figure 19 NBN Broadband Coverage of Torquay-Jan Juc (NBN Co)

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 extensive Taggle and Sigfox coverage in Torquay-Jan Juc.

Public WiFi Coverage

Free WiFi access available at Torquay Tourist Information Centres and libraries.

Access to free WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

Torquay-Jan Juc is not on the VicTrack transmission route. 220v power is available approximately 4 kilometres north-west of Torquay.

3.4 City of Lara

Lara is a small-town north of the City of Greater Geelong, 18 kilometres north-east of the Geelong CBD. The area was originally named Kennedy's Creek but was also given several different names including Duck Ponds, Hovell's Creek, Cheddar, Swindon and Lara Lake. The town's history is being preserved at the Lara Museum and Historical Centre.

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

- The population of Lara grew by 26.7% over a decade to 13,334 in 2016
- 6,910 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 58.6% being in full-time employment and 31.7% in part-time employment
- 9.3% of the labour force classified themselves as managers, 16.3% as professionals and 12.7% as clerical and administrative workers
- 3.8% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- There are no hospitals in the city but there are several located in Geelong to the south of the city
- The city has three primary schools
- With a median age of 36, Lara has one of the youngest populations in regional Victoria and is below the Victorian median of 37
- The ABS report a median annual household income of \$81.1K for Lara, one of the highest in the region and just above Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 235 businesses in the city or its near surrounds
- In 86.7% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 24.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 22.2% have completed level III or IV trade certificates
- another 14.8% have completed year 12.

ABS Industry employment data from 2016 indicated that the Geelong LGA had 6.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the city of Lara 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 show locations serviced by NBN satellite. The brown/stripped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that premises in Lara, except some being serviced by FTTP, FTTN and fixed wireless, are yet to receive NBN services as most services are in construction or being planned.

Lara will be largely serviced by NBN FTTN and FTTC with small pockets of FTTP and fixed wireless in areas surrounding the city.

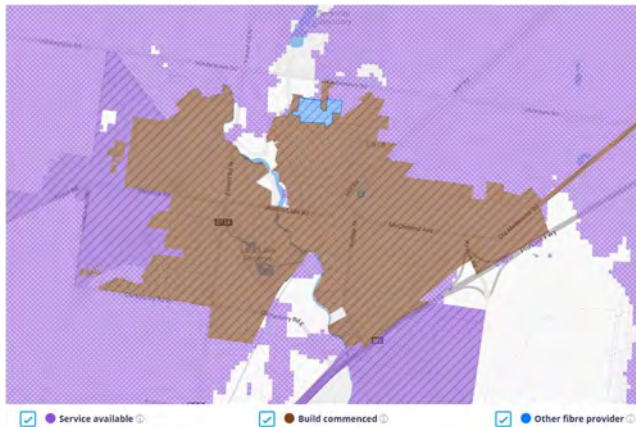


Figure 20 NBN Broadband Coverage of Lara (NBN Co)

Our analysis shows a Lara business, Boomaroo Nurseries and Whole Supplies (corner of Saint Andrews Drive and Spalding Street), that will eventually be serviced by NBN fixed wireless as services are in construction or being planned.



Figure 21 Aerial imagery showing proposed NBN fixed wireless Coverage of Boomaroo Nurseries and Whole Supplies in Lara (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 extensive Taggle and Sigfox coverage in Lara.

Public WiFi Coverage

Free WiFi access available at the Lara library.

Access to free WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

VicTrack fibre transits through the centre of Lara, following the route of the train line with 220v power transiting along the Princess Highway. Utilising spare capacity on this fibre could enable high-speed connectivity to Melbourne.



Figure 22 VicTrack fibre and power transiting Lara

3.5 City of Drysdale-Clifton Springs

Drysdale-Clifton Springs is a coastal population centre located on the Bellarine Peninsula, to the south-east of Geelong. The area overlooks Corio Bay, the You Yangs and Geelong. The area has undergone significant changes over the past decade, with new housing developments on the north side of the town.

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

- The population of Drysdale-Clifton Springs grew by 22.2% over a decade to 12,482 in 2016
- 5,606 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 36.9% in part-time employment
- 9.4% of the labour force classified themselves as managers, 16.4% as professionals and 12.8% as clerical and administrative workers
- 5.1% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 3.7% cited aged care residential, and 2.6% cited local government administration
- There are no hospitals in the city but there are several located in Geelong to the north-west of the city
- The city has three primary schools and a primary/secondary school
- With a median age of 45, Drysdale-Clifton Springs is older than the median of 42 for major population centres analysed in the region and above the Victorian median of 37
- The ABS report a median annual household income of \$59.5K for Drysdale-Clifton Springs, below Melbourne's \$80.4K and below the median of \$62.9K for major population centres analysed in the region
- Data in SLIM on businesses registered with WorkCover indicates approximately 230 businesses in the city or its near surrounds
- In 82.2% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 23.9% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 22.1% have completed level III or IV trade certificates
- another 12.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Geelong LGA had 6.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the city of Drysdale-Clifton Springs 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Drysdale-Clifton Springs will be largely serviced by NBN FTTN, with small pockets of FTTP, and fixed wireless and satellite in areas surrounding the city.

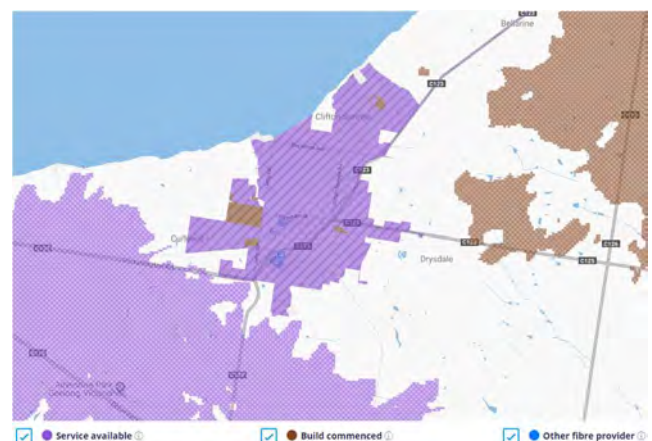


Figure 23 NBN Broadband Coverage of Drysdale-Clifton Springs (NBN Co)

Examining a satellite map of the same area shows that most of the Drysdale-Clifton Springs premises in the township fall within the fixed line area.



Figure 24 Aerial imagery of the premises within the fixed line footprint (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 extensive Taggle and Sigfox coverage in Drysdale-Clifton Springs.

Public WiFi Coverage

There are no known free WiFi zones in Clifton Springs-Drysdale.

Other

Clifton-Springs Drysdale is neither on the VicTrack or the power transmission routes.

3.6 City of Colac

Colac is a small city approximately 150 kilometres south-west of Melbourne on the southern shore of Lake Colac and the surrounding volcanic plains. A commercial centre for a major agricultural district, it

was named after nearby Lake Colac and was proclaimed a city in 1960.

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

- The population of Colac grew by 9.5% over a decade to 11,891 in 2016, one of the lower growth rates for the region
- 5,359 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 53.6% being in full-time employment and 36.1% in part-time employment
- 10.0% of the labour force classified themselves as managers, 11.7% as professionals and 9.9% as clerical and administrative workers
- 4.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- One public hospital is located in the city
- The city has five primary schools, a primary/secondary school and a TAFE
- With a median age of 42, Colac is equal to the median of the major population centres analysed in the region
- The ABS report a median annual household income of \$54.8K for Colac, below the median of \$62.9K for major population centres analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 464 businesses in the city or its near surrounds
- In 71.6% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 16.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.2% have completed level III or IV trade certificates
- another 11.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Colac-Otway LGA had 4.1% employment in

the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the city of Colac 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 show locations serviced by NBN satellite.

Our analysis shows that Colac will be largely serviced by NBN FTTN, with small pockets of FTTP, with fixed wireless and satellite in areas surrounding the city.

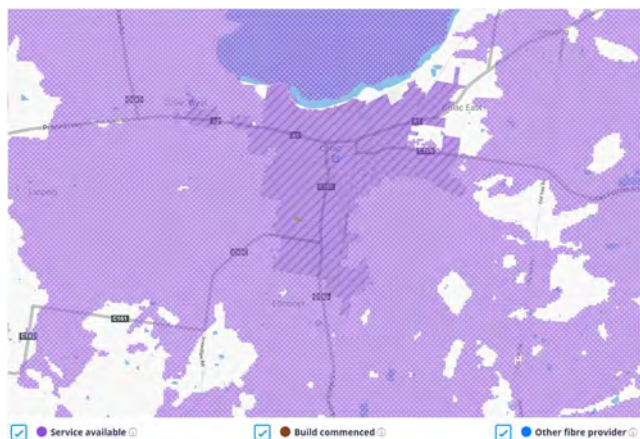


Figure 25 NBN Broadband Coverage of Colac (NBN Co)

Examining a satellite map shows several Colac businesses, such as Australia Lamb Colac (Tristania Drive) and Panther Industries (Forest Street) that are being serviced by NBN satellite.



Figure 26 Aerial imagery showing NBN satellite Coverage of Australia Lamb Colac (NBN Co)



Figure 27 Aerial imagery showing NBN satellite Coverage of Australia Panther Industries in Colac (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 extensive Taggle coverage in Colac.

Public WiFi Coverage

Free WiFi is available at the Colac Tourist Information Centre and the Colac Library.

Other

220v Power is available approximately 4 kilometres south of the Colac CBD. VicTrack fibre transits through the centre of Colac, following the route of the train line.

3.7 City of Leopold

Leopold is a residential eastern suburb of Geelong and is a gateway to the Bellarine Peninsula. The Bellarine Rail Trail passes through

Leopold. The city also has a number of heritage listed sites.

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

- The population of Leopold grew by 45.5% over a decade to 11,875 in 2016, one of the highest growth rates in the region
- 5,949 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 54.7% being in full-time employment and 34.6% in part-time employment
- 9.9% of the labour force classified themselves as managers, 15.5% as professionals and 13.9% as clerical and administrative workers
- 5.7% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.0% cited aged care residential
- There are no hospitals in the city but there are several located nearby in Geelong
- The city has one primary school
- With a median age of 37, Leopold has one of the youngest populations in regional Victoria and which is the same as the Victorian median
- The ABS report a median annual household income of \$71.7K for Leopold, one of the highest in the region but still below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 173 businesses in the city or its near surrounds
- In 86.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 24.1% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 23.6% have completed level III or IV trade certificates
- another 13.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Geelong LGA had 6.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the City of Leopold 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Leopold will be largely serviced by NBN FTTN, with small pockets of FTTP, with fixed wireless and satellite in areas surrounding the city.

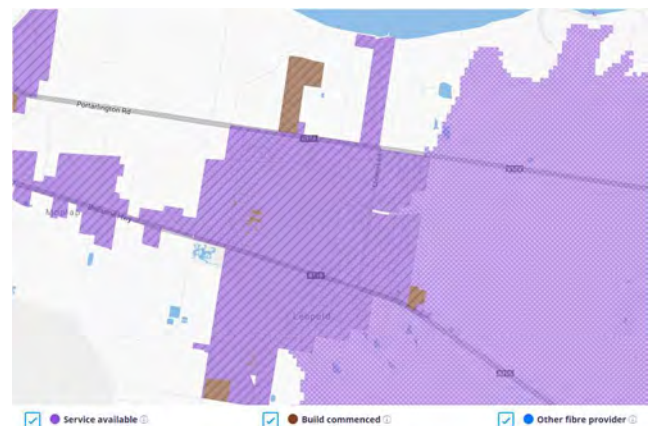


Figure 28 NBN Broadband Coverage of Leopold (NBN Co)

Examining a satellite map of the same area shows that most of the premises in Leopold fall within the FTTP or FTTN area. Premises located closer to the coast will be covered by NBN satellite.

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 extensive Taggle and Sigfox coverage in Leopold.

Public WiFi Coverage

24-hour Free WiFi is available at the Leopold Library.

Other

220v Power is available approximately 4 kilometres west of the Leopold CBD. Leopold is not on the VicTrack or transmission route.

No details are available of optical fibres connectivity provided by other MNOs.

3.8 Town of Portarlington-St Leonards

Portarlington-St Leonards is a coastal population centre near Geelong, at the eastern end of the Bellarine Peninsula and the northern end of Swan Bay. The area is surrounded by salt marsh wildlife reserves which provide habitat for hundreds of birds. The area has a diverse population which includes a wide range of ethnic backgrounds, a high proportion of retirees, and a large seasonal holiday influx.

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

- The population of Portarlington-St Leonards grew by 48.2% over a decade to 6,881 in 2016, one of the highest growth rates in the region
- 2,345 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 47.0% being in full-time employment and 37.7% in part-time employment
- 11.2% of the labour force classified themselves as managers, 18.0% as professionals and 13.2% as clerical and administrative workers

- 3.8% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.5% cited aged care residential
- There are no hospitals in the city but there are several located in Geelong to the north-west
- The town has two primary schools
- With a median age of 58, Portarlington-St Leonards has one of the oldest populations in the region
- The ABS report a median annual household income of \$45.4K for Portarlington-St Leonards, the lowest of the major population centres analysed in the region and well below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 150 businesses in the town or its near surrounds
- In 74.5% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 22.9% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 18.6% have completed level III or IV trade certificates
- another 9.9% have completed year 12.

ABS Industry employment data from 2016 indicated that the Geelong LGA had 6.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the town of Portarlington-St Leonards 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Portarlington-St Leonards will be largely serviced by NBN FTTN, with small

pockets of FTTTP, with fixed wireless and satellite in areas surrounding the city.

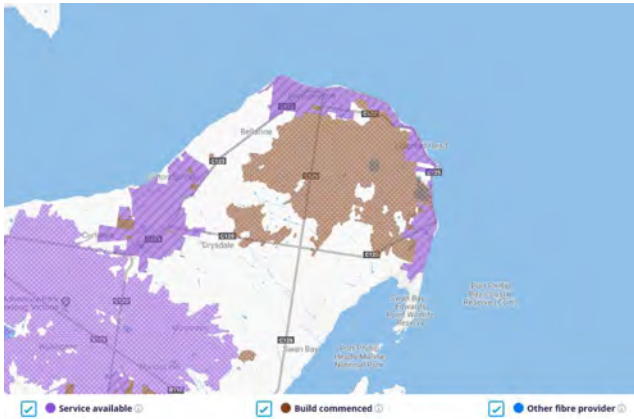


Figure 29 NBN Broadband Coverage of Portarlington-St Leonards (NBN Co)

Examining a satellite map of the same area shows that most of the premises in Portarlington-St Leonards fall within the FTTTP or FTTN 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.

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 and Sigfox coverage in Portarlington-St Leonards.

Public WiFi Coverage

There are no known free WiFi zones in Portarlington-St Leonards

Other

Portarlington-St Leonards is neither on the VicTrack or the power transmission routes.

3.9 Town of Point Lonsdale-Queenscliff

Point Lonsdale-Queenscliff is a coastal township on the Bellarine Peninsula. Point Lonsdale is also one of the headlands which, with Point Nepean, frame The Rip, the entrance to Port Phillip. Queenscliff is a former 1880s seaside resort now known for its Victorian era heritage and tourist industry and as one of the endpoints of the Searoad ferry to Sorrento on the Mornington Peninsula.

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

- The population of Point Lonsdale-Queenscliff was 3,751 in 2016. 2006 ABS census data did not capture Point Lonsdale at an adequate statistical level to enable a 10-year growth rate for the area to be calculated
- 1,394 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 47.6% being in full-time employment and 42.5% in part-time employment
- 16.2% of the labour force classified themselves as managers, 31.2% as professionals and 12.0% as clerical and administrative workers
- 5.2% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- There are no hospitals in the city but there are several located in Geelong to the north-west
- The town has three primary schools
- With a median age of 59, Point Lonsdale-Queenscliff has one of the oldest populations in regional Victoria, and well above the Victorian median of 37
- The ABS report a median annual household income of \$62.2K for Point Lonsdale-Queenscliff, just below the median of \$62.8K for the major population centres analysed in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 195 businesses in the town or its near surrounds
- In 85.1% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 44.5% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 10.3% have completed level III or IV trade certificates
- another 10.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Queenscliff LGA had 10.0% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the town of Point Lonsdale-Queenscliff 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Point Lonsdale-Queenscliff will be largely serviced by NBN FTTN, with small pockets of FTTP, with fixed wireless and satellite in areas surrounding the city.



Figure 30 NBN Broadband Coverage of Point Lonsdale-Queenscliff (NBN Co)

Our analysis shows that most premises in Point Lonsdale-Queenscliff town fall within the FTTP or FTTN area. Examining a satellite map of the same

area shows that the Queenscliff Scientific Marine Research Centre is being serviced by NBN satellite.



Figure 31 Aerial imagery showing NBN satellite Coverage of the Queenscliff Scientific Marine Research Centre in Queenscliff (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 extensive Taggle and Sigfox coverage in Point Lonsdale - Queenscliff.

Public WiFi Coverage

Free WiFi is available at the Queenscliff library and tourist information centre.

Other

Point Lonsdale-Queenscliff is neither on the VicTrack or the power transmission routes.

3.10 Town of Anglesea

Anglesea is located on the Great Ocean Road in the Surf Coast Shire local government area.

Originally known as Swampy Creek, the area's name was changed to Anglesea River in 1884 when the township was established. There is a surge in population during the summer months, reaching a peak around Christmas and New Year's Eve, as many Melbourne residents arrive for the holiday season.

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

- The population of Anglesea grew by 10.8% over a decade to 2,538 in 2016, below the median growth rate of 18.7% for the major population centres analysed for the region
- 1,179 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 39.1% in part-time employment
- 13.7% of the labour force classified themselves as managers, 25.5% as professionals and 11.4% as clerical and administrative workers
- 3.0% of the labour force cited their industry of employment as local government administration
- There is no hospital in the town, but there are hospitals located in Lorne to the south-west, in Winchelsea to the north-west and Geelong to the north-east
- The town has one primary school
- With a median age of 51, Anglesea is older than the median of 42 for the major population centres in the region, and above the Victorian median of 37
- The ABS report a median annual household income of \$67.0K for Anglesea, above the median of \$62.8K of the major population centres of the region analysed, but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 95 businesses in the town or its near surrounds
- In 84.5% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 41.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 15.7% have completed level III or IV trade certificates
- another 10.0% have completed year 12.

ABS Industry employment data from 2016 indicated that the Surf Coast LGA had 8.1% employment in the industry sectors with strong technology exposure.

Fixed Broadband

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

Our analysis shows that Anglesea will be largely serviced by NBN FTTN, with a small pocket of FTTP, with satellite in areas surrounding the city.

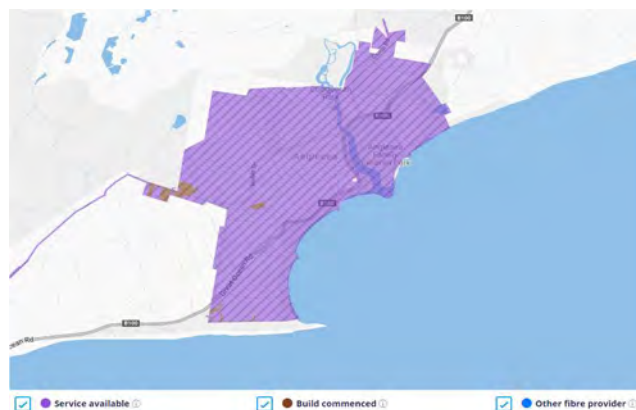


Figure 32 NBN Broadband Coverage of Anglesea (NBN Co)

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 extensive Taggle and Sigfox coverage in Anglesea.

Public WiFi Coverage

There are no known free public WiFi zones in Anglesea.

Other

220v power is available from the Anglesea Power Station.

Anglesea is not on the VicTrack transmission route.

3.11 Town of Winchelsea

Winchelsea is located on the Barwon River 115 kilometres south-west of Melbourne and close to Geelong (37 kilometres north-east). The first Europeans to reside in the area were squatters who established grazing runs there. The town was the administrative centre of the Shire of Winchelsea, which was proclaimed in 1864, and which continued until March 9, 1994 when it was amalgamated with the Shire of Barrabool to become the Surf Coast Shire.

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

- The population of Winchelsea grew by 18.7% over a decade to 1,586 in 2016, which is the median growth rate of the major population centres analysed in the region
- 649 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 49.3% being in full-time employment and 35.6% in part-time employment
- 10.3% of the labour force classified themselves as managers, 12.4% as professionals and 8.6% as clerical and administrative workers

- 6.0% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 5.1% cited aged care residential
- One public hospital is located in the town
- The town has one primary school
- With a median age of 48, Winchelsea is older than the median of 42 for the major population centres analysed in the region and above the Victorian median of 37
- The ABS report a median annual household income of \$49.2K for Winchelsea, below the median of \$62.9K for the major population centres analysed in the region
- Data in SLIM on businesses registered with WorkCover indicates approximately 96 businesses in the town or its near surrounds
- In 71.6% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 15.5% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.7% have completed level III or IV trade certificates
- another 11.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Surf Coast LGA had 8.1% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the Town of Winchelsea 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 show locations serviced by NBN satellite.

Our analysis shows that Winchelsea will be largely serviced by NBN FTTN, with small pockets of FTTP, with fixed wireless and satellite in areas surrounding the city.

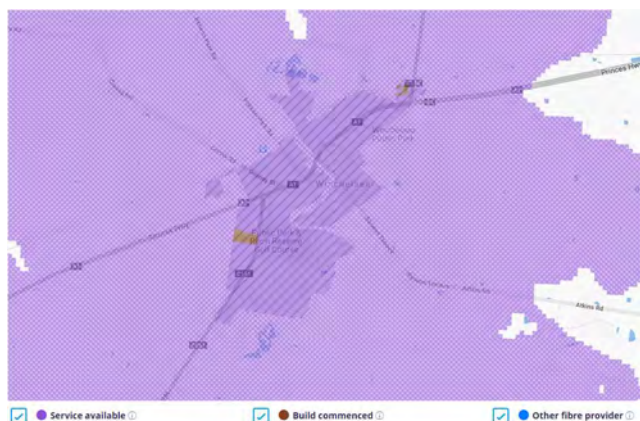


Figure 33 NBN Broadband Coverage of Winchelsea (NBN Co)

Examining a satellite map of the same area shows that most of the premises in Winchelsea fall within the FTTN or FTTN 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.

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 Winchelsea.

Public WiFi Coverage

Free WiFi access available at the Winchelsea library.

Access to free WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

VicTrack fibre transits through the centre of Winchelsea, following the route of the train line with 220v power transiting along the northern fringes of the town.

Utilising spare capacity on this fibre could enable high-speed connectivity to Melbourne.

3.12 Town of Apollo Bay

Apollo Bay is situated on the eastern side of Cape Otway, along the edge of the Barham River and on the Great Ocean Road, in the Colac Otway Shire. The town is a popular tourist destination, though it is smaller and quieter than other nearby places such as Lorne. It is also host to the annual Apollo Bay Music Festival and the Great Ocean Sports Festival.

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

- The population of Apollo Bay declined by 0.4% over a decade to 1,366 in 2016, making it one of only three population centres to experience a population decline of the 16 places analysed
- 631 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 44.4% being in full-time employment and 44.2% in part-time employment
- 16.3% of the labour force classified themselves as managers, 13.1% as professionals and 8.1% as clerical and administrative workers
- 16.1% of the labour force cited their industry of employment as accommodation
- One public hospital is located in the town
- The town has one primary school
- With a median age of 48, Apollo Bay is older than the median of 42 for the major population centres analysed in the region and above the Victorian median of 37
- The ABS report a median annual household income of \$47.8K for Apollo Bay, below the median of \$62.9K for the major population centres analysed in the region
- Data in SLIM on businesses registered with WorkCover indicates approximately 123 businesses in the town or its near surrounds
- In 76.4% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 26.0% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification

- another 19.4% have completed level III or IV trade certificates
- another 13.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Colac-Otway LGA had 4.1% employment in the industry sectors with strong technology exposure.

Fixed Broadband

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

Apollo Bay will be largely serviced by NBN FTTN, with small pockets of FTTP (for example, Ocean Park Drive Marengo), with fixed wireless and satellite in areas surrounding the city.

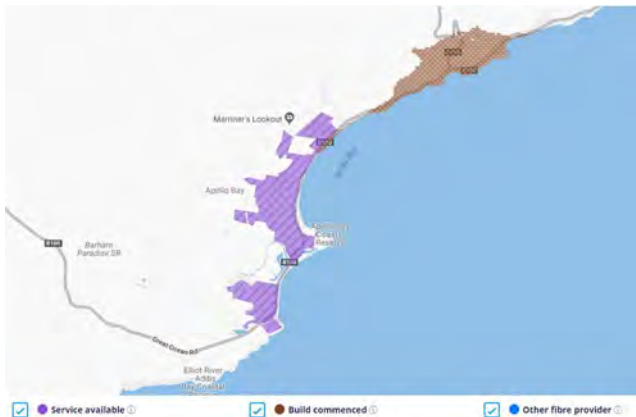


Figure 34 NBN Broadband Coverage of Apollo Bay (NBN Co)

Examining a satellite map of the same area shows that most of the premises in Apollo Bay fall within the FTTP or FTTN 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.

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 Apollo Bay.

Public WiFi Coverage

24-hour free WiFi access available at the Apollo bay library.

Access to free WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

Point Lonsdale-Queenscliff is neither on the VicTrack or the power transmission routes.

3.13 Town of Aireys Inlet-Fairhaven

Aireys Inlet-Fairhaven is a small coastal population centre located along the Great Ocean Road in the Surf Coast Shire of Victoria. The area is a popular holiday destination, with many homes being used for that purpose. Fairhaven Beach is a popular spot for surfers, and the Split Point Lighthouse in Aireys Inlet is one of the main attractions of the town making it an icon along the Great Ocean Road.

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

- The population of Aireys Inlet-Fairhaven declined by 2.8% over a decade to 1,116 in 2016, the second lowest of the 16 most significant population centres analysed in the region
- 519 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 45.7% being in full-time employment and 47.6% in part-time employment
- 17.5% of the labour force classified themselves as managers, 28.2% as professionals and 7.8% as clerical and administrative workers

- 6.8% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.6% cited local government administration
- There are no hospitals in the town, but there is a public hospital in Lorne nearby to the south-west
- The town has one primary school
- With a median age of 53, Aireys Inlet-Fairhaven has one of the older populations in the region
- The ABS report a median annual household income of \$63.1K for Aireys Inlet-Fairhaven, just above the median of \$62.9K for the biggest population centres in the region but still below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 52 businesses in the town or its near surrounds
- In 89.0% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 43.5% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 15.2% have completed level III or IV trade certificates
- another 11.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Surf Coast LGA had 8.1% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the town of Aireys Inlet-Fairhaven as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services and white areas show locations serviced by NBN satellite.

Our analysis shows that Aireys Inlet-Fairhaven will be largely serviced by NBN FTTN with satellite in areas surrounding the town.

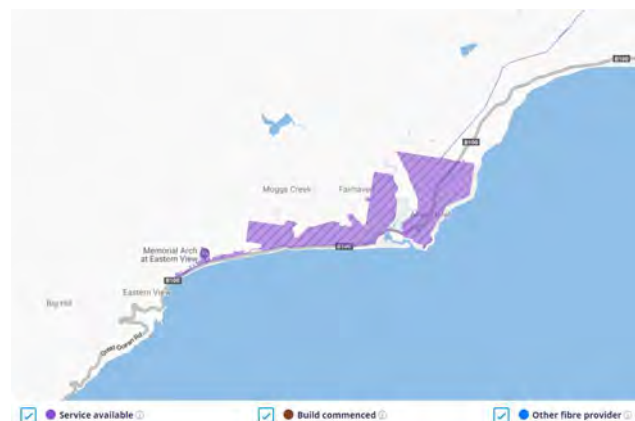


Figure 35 NBN Broadband Coverage of Aireys Inlet-Fairhaven (NBN Co)

Examining a satellite map of the same area shows that most of the premises in Aireys Inlet-Fairhaven fall within the FTTN 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.

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 Colac.

Public WiFi Coverage

24-hour free WiFi access available at the Airey's Inlet library.

Access to free WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

Aireys Inlet-Fairhaven is neither on the VicTrack or the power transmission routes.

3.14 Town of Lorne

Lorne is a seaside town on Louttit Bay in the Surf Coast Shire in Victoria. It is situated about the Erskine River and is a popular destination on the Great Ocean Road tourist route. The town's population swells to around 13,000 each New Year's Eve when the Falls Festival takes place. During the first weekend of January over 20,000 spectators visit Lorne when the town hosts the 1.2 kilometre Pier to Pub swim, the 8 kilometre Mountain to Surf run, and the Lorne Surf Boat Race.

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

- The population of Lorne grew by 6.1% over a decade to 1,026 in 2016, below the median growth rate of 18.7% for the largest population centres in the region
- 481 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 49.7% being in full-time employment and 39.7% in part-time employment
- 23.1% of the labour force classified themselves as managers, 16.2% as professionals and 8.3% as clerical and administrative workers
- 4.3% 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 one primary/secondary school
- With a median age of 54, Lorne has one of the older populations in the region
- The ABS report a median annual household income of \$64.7K for Lorne, just above the median of \$62.9K for the most significant places analysed in the region, but below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 102 businesses in the town or its near surrounds
- In 82.2% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 34.0% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 15.4% have completed level III or IV trade certificates
- another 15.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Surf Coast LGA had 8.1% employment in the industry sectors with strong technology exposure.

Fixed Broadband

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

Our analysis shows that Lorne will be largely serviced by NBN FTTN with a small pocket of FTTP and satellite in areas surrounding the city.

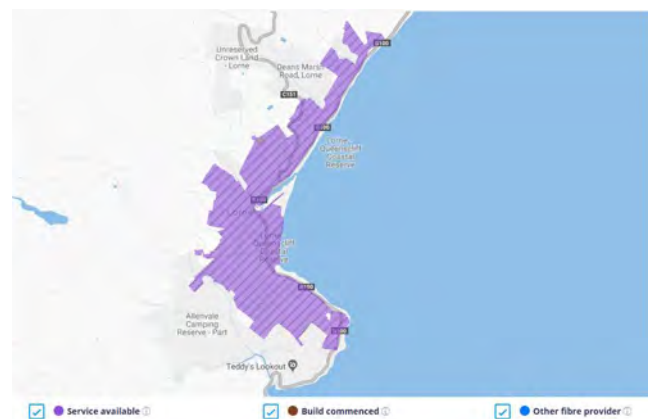


Figure 36 NBN Broadband Coverage of Lorne (NBN Co)

Most premises in Lorne will fall within the FTTN 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.

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 Lorne.

Public WiFi Coverage

There are no known free public WiFi zones in Lorne.

Other

Lorne is neither on the VicTrack or the power transmission routes.

3.15 Locality of Batesford

Batesford is a small town located approximately 10 kilometres west of Geelong and 67 kilometres south-west of Melbourne. Batesford is named after Alfred and John Bates who settled here in 1837 at a place where the river could be forded.

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

- The population of Batesford grew by 47.2% over a decade to 764 in 2016, one of the highest growth rates in the region
- 399 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 48.4% being in full-time employment and 40.1% in part-time employment
- 15.0% of the labour force classified themselves as managers, 19.4% as professionals and 14.0% as clerical and administrative workers
- 8.6% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- There are no hospitals in the town but there are several in nearby Geelong
- The town has one primary school

- With a median age of 42, Batesford has the median age of the major population centres analysed in the region, but above the Victorian median of 37
- The ABS report a median annual household income of \$106.0K for Batesford, one of the highest in Victoria and well above Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately nine businesses in the town or its near surrounds
- In 93.7% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 29.2% 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
- another 14.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Geelong LGA had 6.7% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the locality of Batesford 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 show locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Batesford will be largely serviced by NBN fixed wireless and FTTC mainly in the town's new developments.

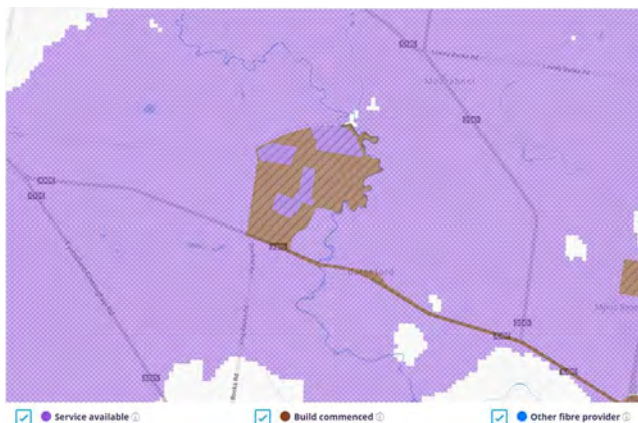


Figure 37 NBN Broadband Coverage of Batesford (NBN Co)

Examining a satellite map of the same area shows that most of the premises in Batesford fall within the NBN fixed wireless or fixed line area.



Figure 38 Aerial imagery showing NBN fixed wireless and fixed line building commenced in Batesford (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 as well as patchy 4G Plus outdoor 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 extensive Taggle and Sigfox coverage in Batesford.

Public WiFi Coverage

There are no known free public WiFi zones available in Batesford.

Other

220v Power is available approximately 1 kilometre north-west of Batesford. VicTrack fibre is available through North Geelong, approximately 6 kilometres east of Batesford.

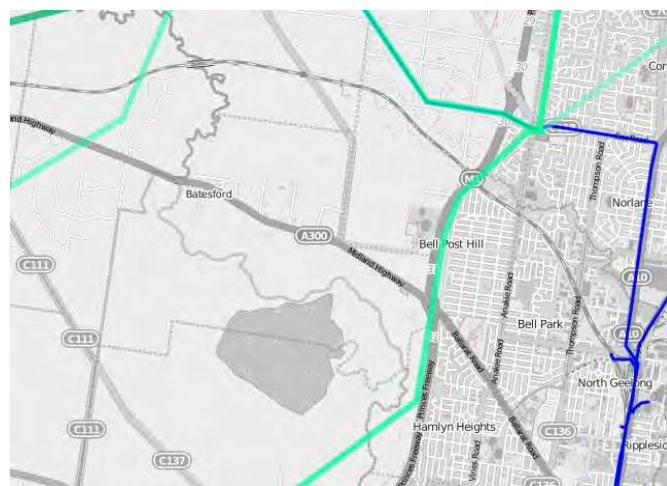


Figure 39 VicTrack fibre and power around Batesford

3.16 Locality of Birregurra

Birregurra is approximately 130 kilometres south-west of Melbourne. The town is divided between the Shire of Colac Otway and the Surf Coast Shire. The town is host to the Birregurra Festival and Art Show. It starts each year on the second full weekend of the month of October.

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

- The population of Birregurra grew by 16.6% over a decade to 540 in 2016, just below the median growth of 18.7% among the major population centres in the region analysed
- 260 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 53.5% being in full-time employment and 34.6% in part-time employment

- 15.9% of the labour force classified themselves as managers, 17.6% as professionals and 6.9% as clerical and administrative workers
- 8.6% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- The nearest hospital is located in Colac to the west
- The town has one primary school
- With a median age of 41, Birregurra is just below the median of 42 for the major population centres in the region
- The ABS report a median annual household income of \$58.9K for Birregurra, below the median of \$62.9K for the major population centres in the region and below Melbourne's \$80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 30 businesses in the town or its near surrounds
- In 78.6% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 28.1% 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
- another 14.0% have completed year 12.

ABS Industry employment data from 2016 indicated that the Colac-Otway LGA had 4.1% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map below shows the status of the NBN rollout in the locality of Birregurra as advised by NBN Co in September 2018. The purple/spotted areas show locations serviced by NBN fixed wireless services and white areas show locations serviced by NBN satellite.

The Birregurra township and surrounding areas is serviced by NBN fixed wireless and satellite.

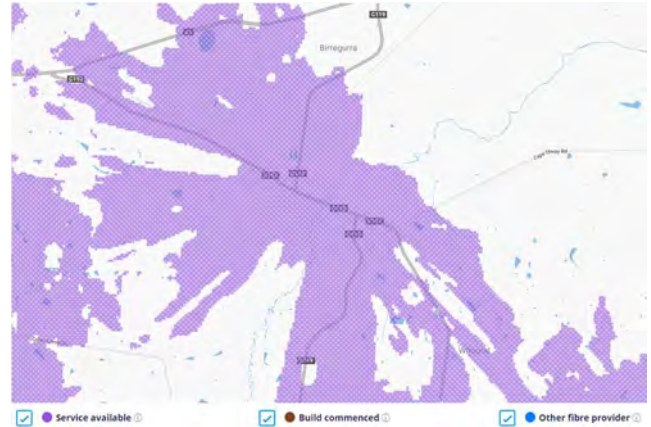


Figure 40 NBN Broadband Coverage of Birregurra (NBN Co)

Examining a satellite map of the same area shows that most of the premises in Birregurra fall within the NBN fixed wireless area.

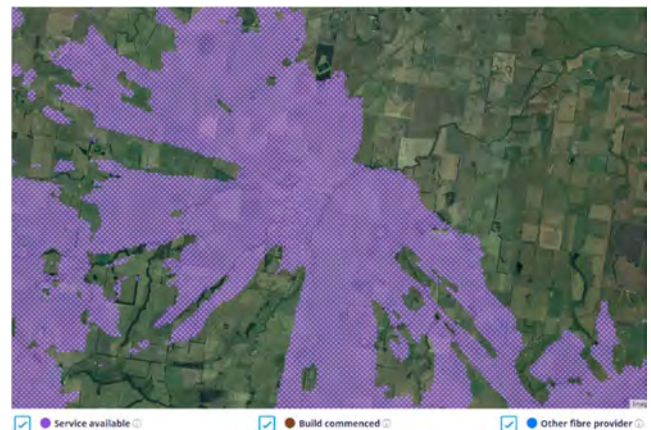


Figure 41 Aerial imagery showing NBN fixed wireless and satellite Coverage in Birregurra (NBN Co)

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 extensive Taggle coverage in Birregurra.

There is limited Sigfox coverage in Birregurra.
Testing may be needed to confirm coverage.

Public WiFi Coverage

Free WiFi access available at the Birregurra library.

Access to free WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

VicTrack fibre transits through the centre of Birregurra, following the route of the train line with 220v power transiting approximately 4.5 kilometres north of the town. Utilising spare capacity on this fibre could enable high-speed connectivity to Melbourne.

No details are available of optical fibres connectivity provided by other MNOs.

4 Primary Production

4.1 Land Use Classification

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

As is evident from the land use map following, the overwhelming categorisation of primary production land across the Barwon region is classified as Grazing – both Dairy and Grazing (sheep and beef). The regional partnership boundary is shown in red.

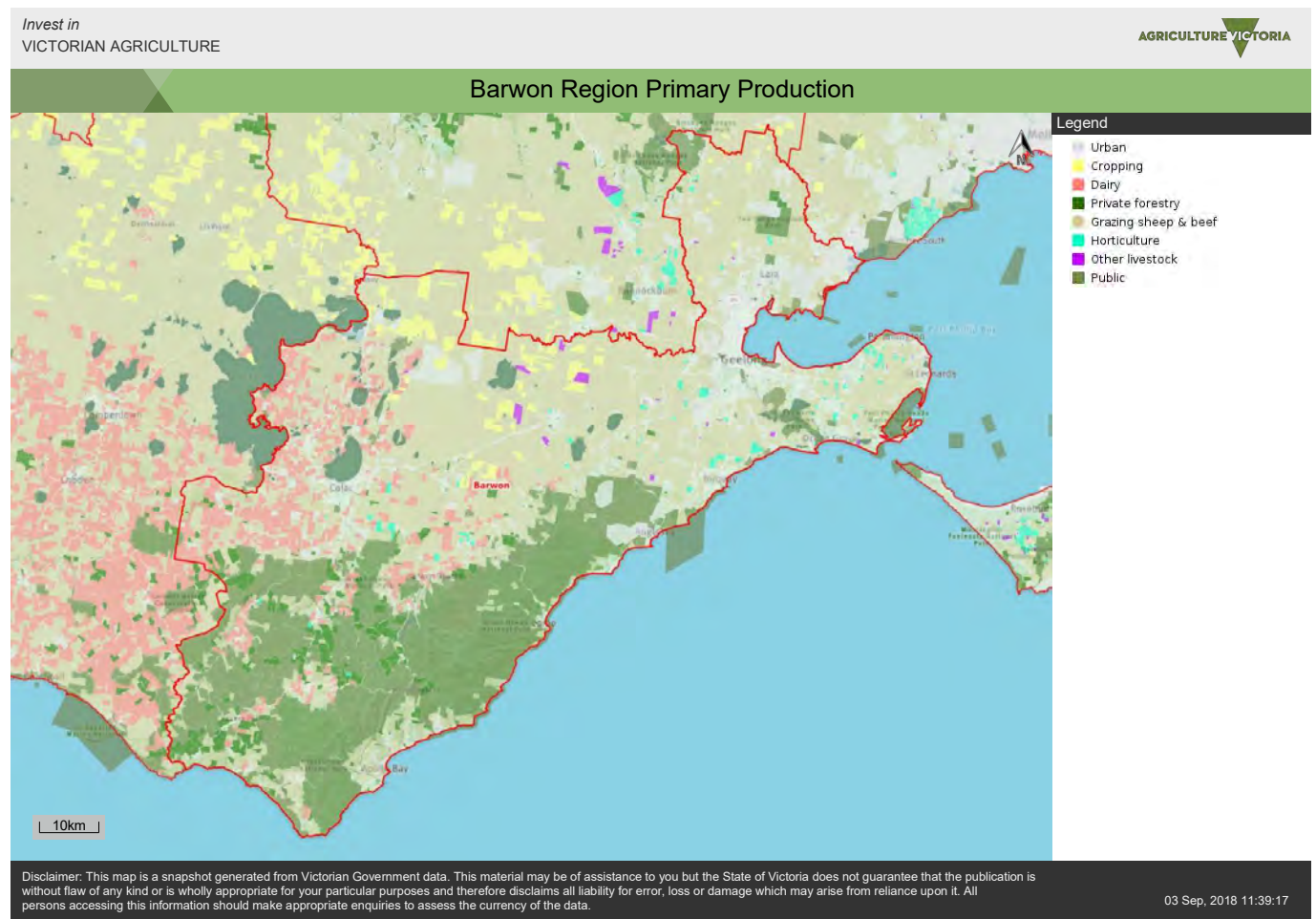


Figure 42 Primary production land in the region (Agriculture Victoria)

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

- in livestock production areas, detailed animal tracking, identification, biometrics and feed management can optimise yields
- in cropping areas, technology for real-time machinery monitoring and guidance is becoming more common, and satellite imagery can provide valuable insights into crop development and health
- in irrigation areas, soil moisture monitoring and water management are becoming increasingly important to minimise costs and maximise production
- in all areas, general access to information *where* and *when* it is needed can support informed decision-making
- with agriculture posing many occupational health and safety risks, access to communications in emergency situations can make the difference between life and death.

In the light of this, all forms of agriculture will need to exploit information technology and communications

more actively in the future if they are to remain globally competitive.

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

In addition, there is substantial downstream food and fibre processing in Barwon, requiring fixed, mobile and (to a lesser extent at present) LP-WAN IoT connectivity.

4.2 Fixed Broadband Supply

NBN Services

The map below shows NBN coverage of the Barwon region.

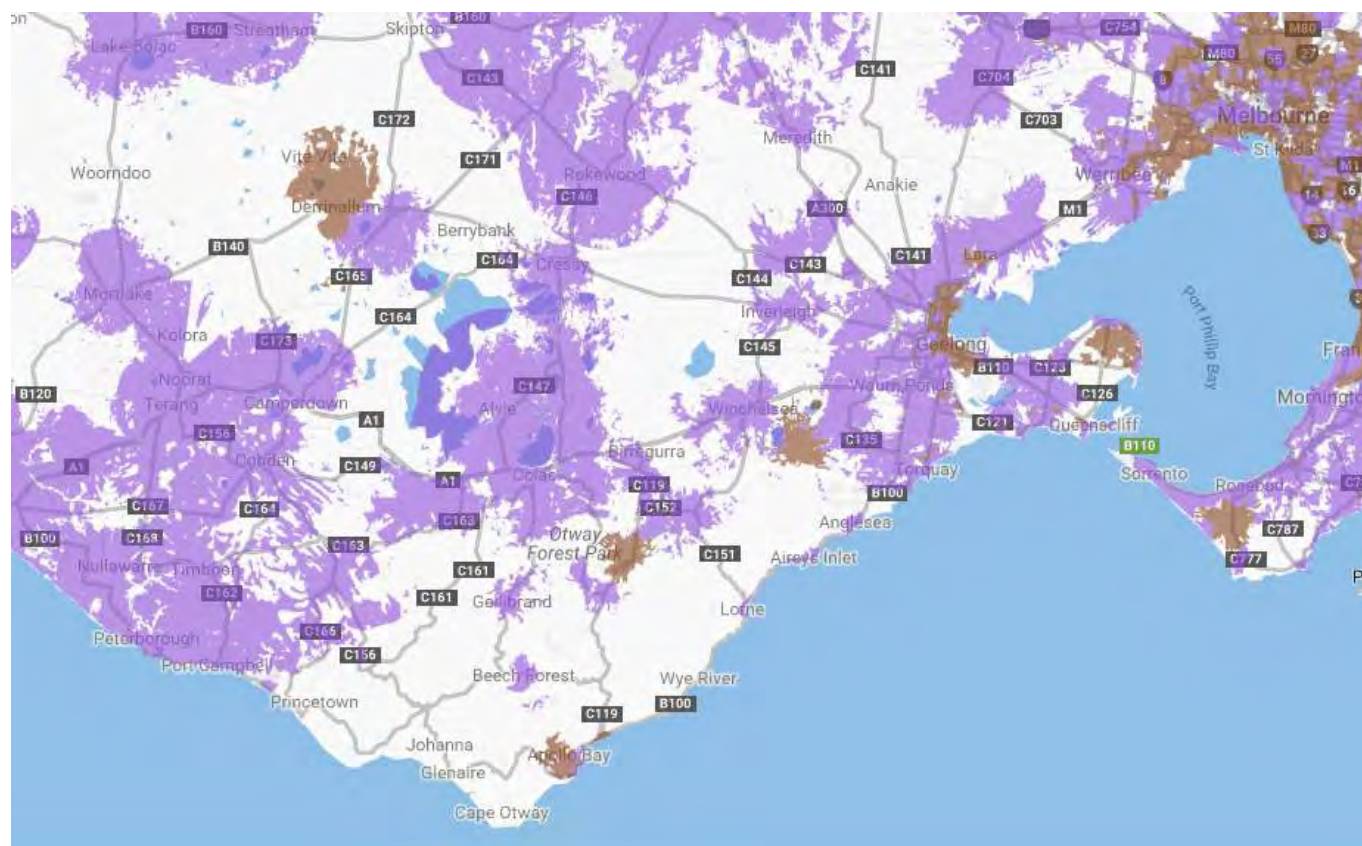


Figure 43 NBN Co Coverage of the Barwon Region (NBN Co)

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 30% of rural land in the Barwon region has access to NBN Co's satellite solution, and most of the remainder has access to (or is due to receive) the higher-performing fixed wireless solution.

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

LGA	Population in Rural Land ¹³	Estimated Area of Satellite Coverage
Colac-Otway	7,175	60%
Geelong	23,882	20%
Queenscliff	0	<5%
Surf Coast	6,710	50%

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.

Grazing

- Dairy
- The area south-west of Colac

The map below shows most farms have NBN fixed wireless coverage with a significant area further west in the NBN satellite footprint.

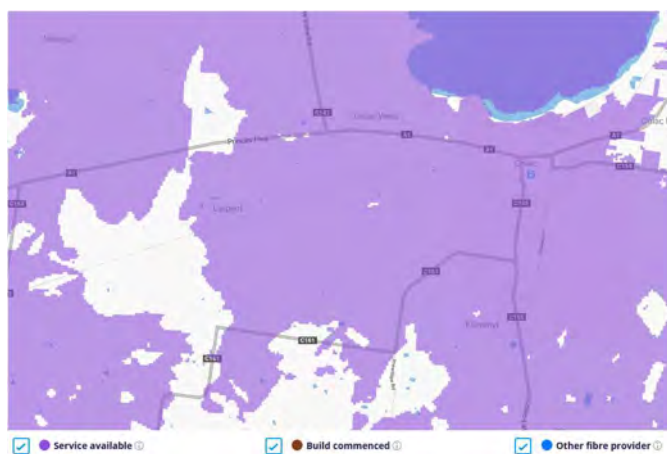


Figure 44 NBN Coverage of the farming area south-west of Colac (NBN Co)

Grazing

- Beef meat
- The area north of Colac

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

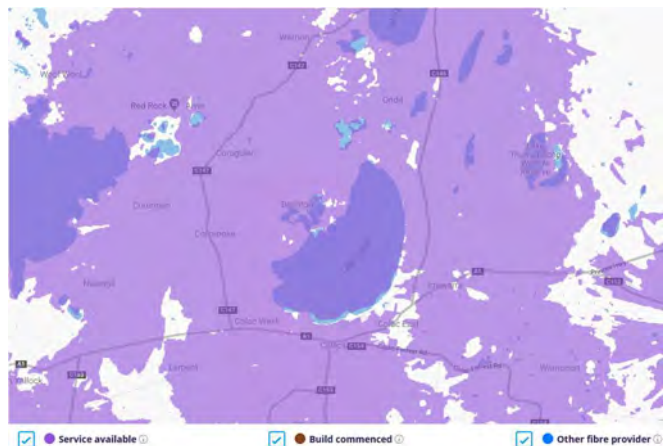


Figure 45 NBN Coverage of the farming area north of Colac (NBN Co)

Poultry

- Chicken meat
- The area around Winchelsea

The map below shows NBN fixed wireless coverage for the farms located in the west and south of Winchelsea with NBN satellite coverage for the farms located north of the town.

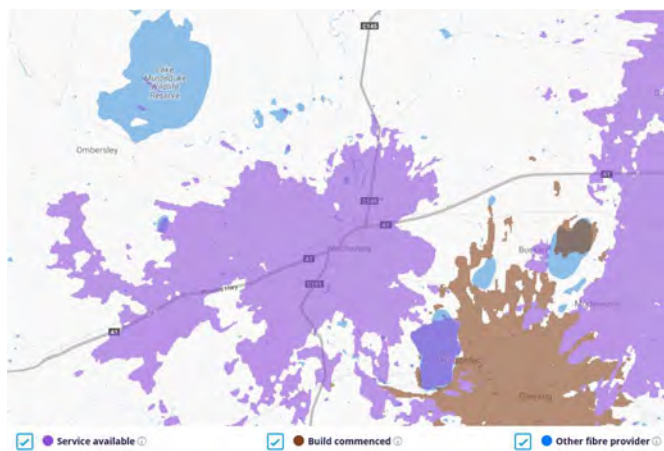


Figure 46 NBN Coverage of the farming area around Winchelsea (NBN Co)

¹³ 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.

Food and Fibre Processing Facility

- *Scotchmans Hill Winery*
- *190 Scotchmans Rd, Drysdale*

The map below shows the Scotchmans Hill Winery is currently serviced by NBN satellite however, NBN fixed wireless is planned for the site.



Figure 47 NBN Coverage of the Scotchmans Hill Winery (NBN Co)

Food and Fibre Processing Facility

- *Organic Dairy Farmers*
- *62-66 Cowie St, North Geelong*

The map below shows the Organic Dairy Farmers will be serviced by NBN FTTC fixed line, due to be connected in the July-September 2019 period.

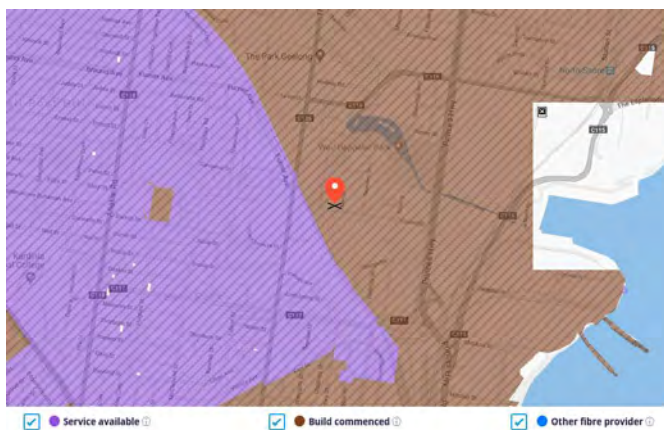


Figure 48 NBN Coverage of the Organic Dairy Farmers (NBN Co)

Food and Fibre Processing Facility

- *AKD Softwoods (Forestry and Timber)*
- *7-15 Forest St, Colac*

The map below shows AKD Softwoods main office falls on the edge of the NBN FTTN fixed line footprint with

the remaining area of the facility serviced by fixed wireless and satellite.

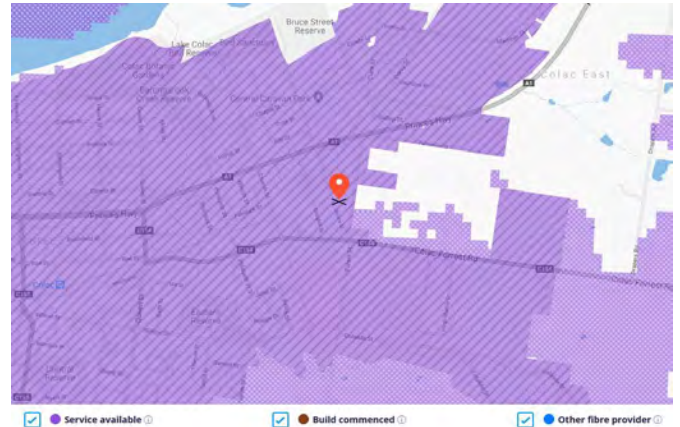


Figure 49 NBN Coverage of AKD Softwoods (NBN Co)

Other Fixed Connectivity Options

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

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

More Detailed 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, used as an example only.

In this map:

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

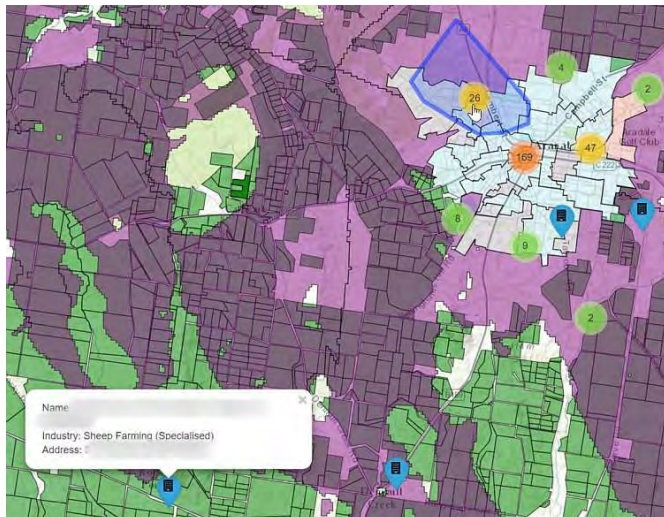


Figure 50 SLIM outputs at a more detailed level (SLIM)

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

4.3 Mobile Coverage

Simple visual examination of these maps of Telstra and Optus suggest extensive coverage across the Barwon 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.

Grazing

- Dairy
- The area south-west of Colac

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to

conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage across most of the region, with a small area of 3G outdoor coverage north of Barongarook
- Optus shows inconsistent 4G Plus and 3G outdoor coverage across the area with new coverage under construction near Piron Yallock. However, coverage is concentrated along the Princess Highway and does not extend southwards as far as Barongarook.
- Vodafone shows continuous 4G indoor and outdoor coverage with 3G outdoor coverage extending past southwards beyond Barongarook.

In summary, there appear to be medium level mobile coverage in the area, with only one mobile network operator offering 4G service.

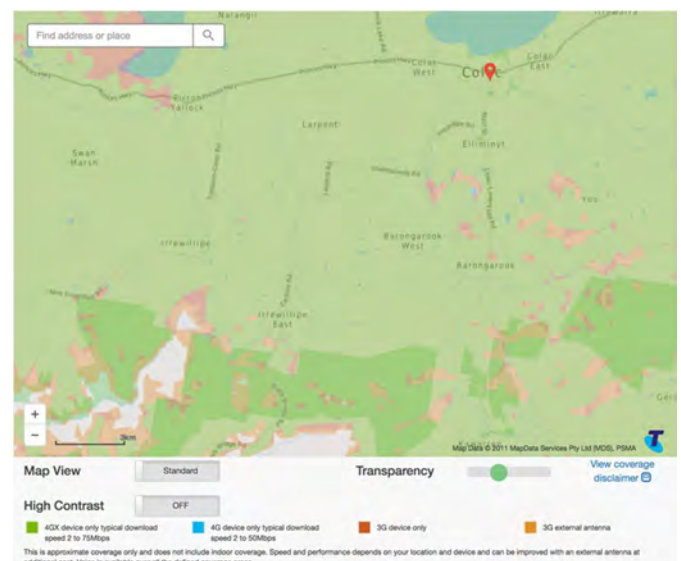


Figure 51 Telstra mobile coverage south-west of Colac

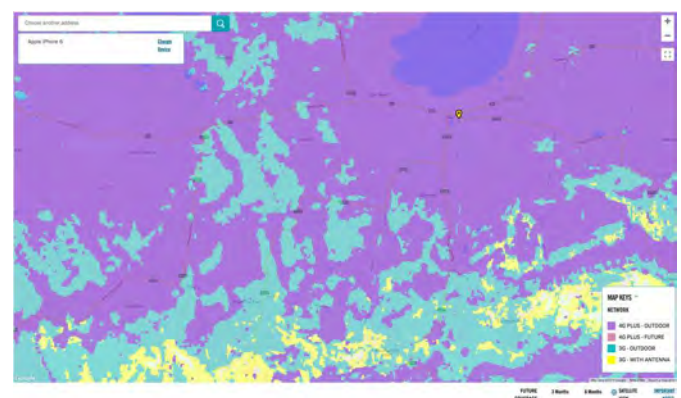


Figure 52 Optus mobile coverage south-west of Colac



Figure 53 Vodafone mobile coverage south-west of Colac

Grazing

- Beef meat
- The area north of Colac

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

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) and 3G external antenna coverage across the region. No black spots are evident.
- Optus shows 4G Plus and 3G outdoor coverage with small patches of 3G external antenna coverage across the region. No black spots are evident.
- Vodafone shows 4G indoor and outdoor and an area of patchy 3G around Dreeite.

In summary, there appear to be medium level mobile coverage in the area, with only one mobile network operator offering 4G service

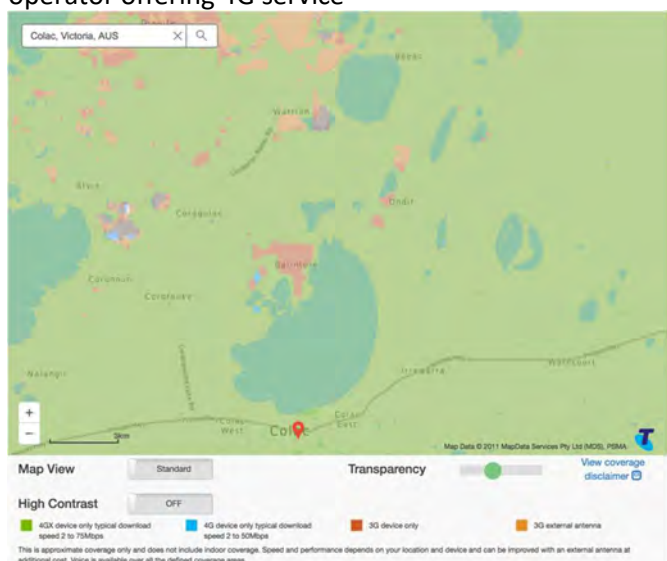


Figure 54 Telstra mobile coverage in the area north of Colac

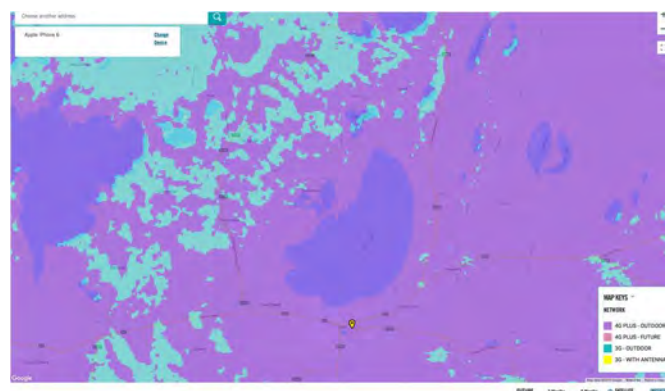


Figure 55 Optus mobile coverage in the area north of Colac



Figure 56 Vodafone mobile coverage in the area north of Colac

Poultry

- Chicken meat
- The area around Winchelsea

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

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the area
- Optus shows 4G Plus and 3G outdoor coverage across the entire region with much of the 3G coverage near Ambersley being upgraded to 4G Plus
- Vodafone shows continuous 4G indoor and outdoor coverage across the area with new coverage under construction near Lake Murdeduke.

In summary, there is consistent mobile coverage in the area from all three mobile network operators.

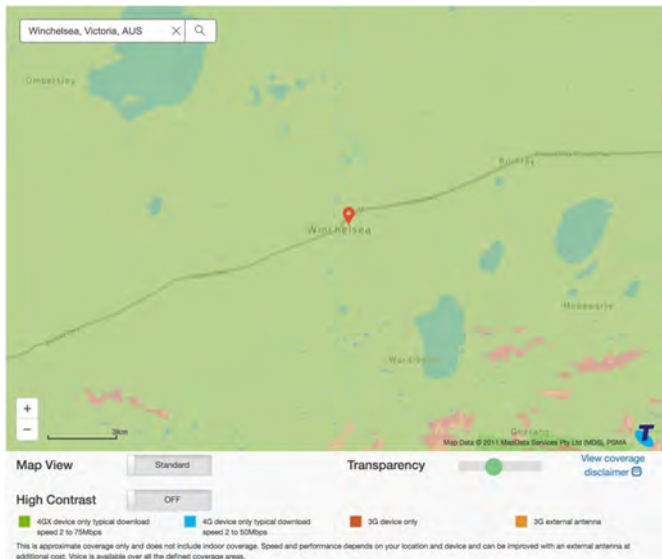


Figure 57 Telstra mobile coverage in the area around Winchelsea

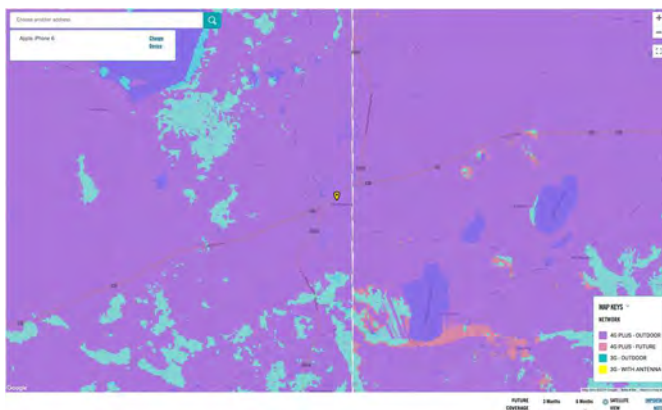


Figure 58 Optus mobile coverage in the area around Winchelsea

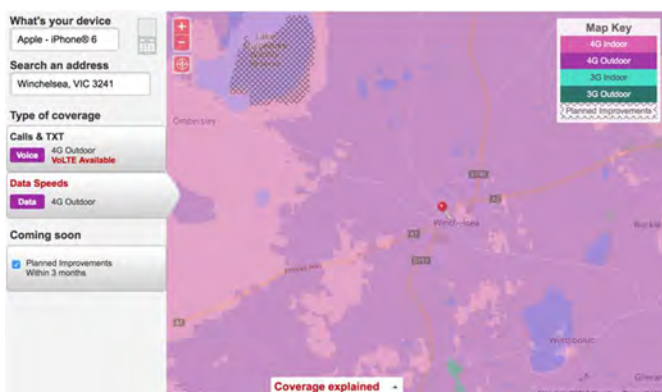


Figure 59 Vodafone mobile coverage in the area around Winchelsea

conduct detailed analysis, so comments are general in nature. 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 indoor coverage of the winery.

In summary, there appears to be 4G coverage of the winery with the three major mobile network operators all offering service.



Figure 60 Telstra mobile coverage of Scotchmans Hill Winery

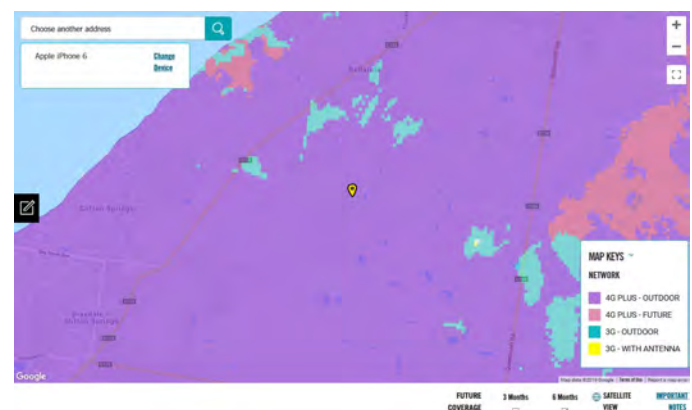


Figure 61 Optus mobile coverage of Scotchmans Hill Winery

Food and Fibre Processing Facility

- Scotchmans Hill Winery
- 190 Scotchmans Rd, Drysdale

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to

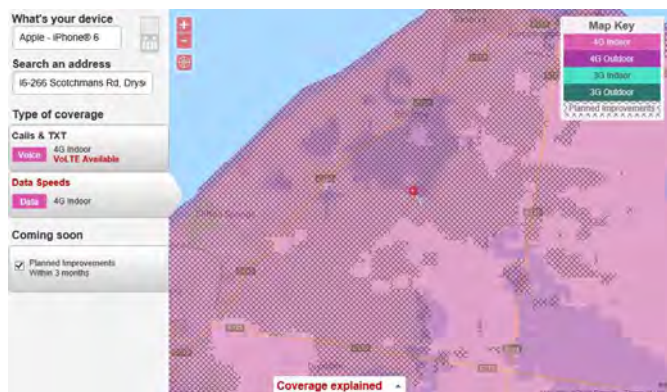


Figure 62 Vodafone mobile coverage of Scotchmans Hill Winery

Food and Fibre Processing Facility

- Organic Dairy Farmers
- 62-66 Cowie St, North Geelong

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

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

In summary, there appears to be 4G coverage of the winery with the three major mobile network operators all offering service.

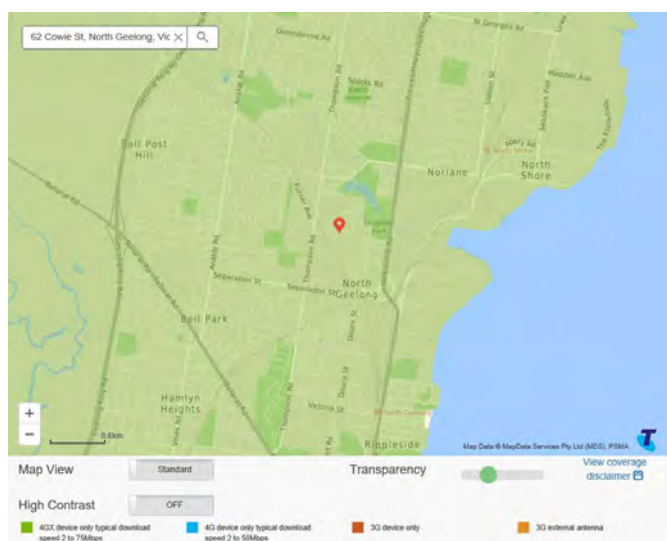


Figure 63 Telstra mobile coverage of Organic Dairy Farmers facility

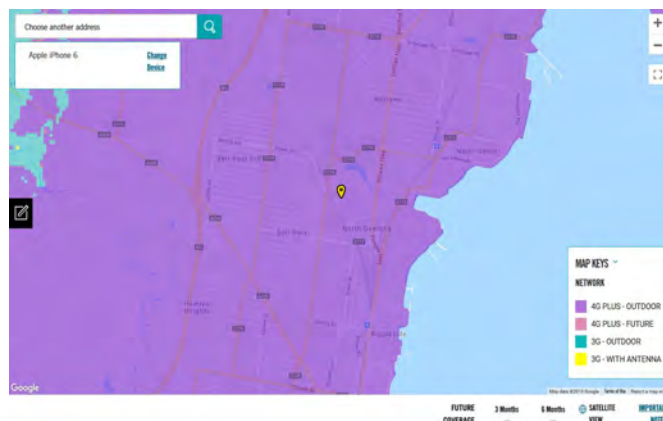


Figure 64 Optus mobile coverage of Organic Dairy Farmers facility

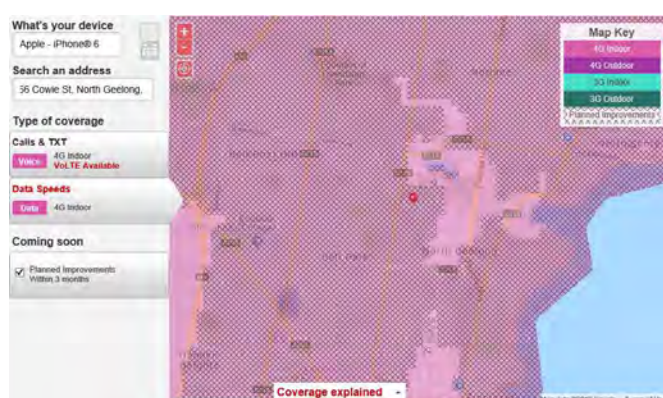


Figure 65 Vodafone mobile coverage of Organic Dairy Farmers facility

Food and Fibre Processing Facility

- AKD Softwood (Forestry and Timber)
- 7-15 Forest St, Colac

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

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

In summary, there appears to be 4G coverage of the AKD Softwood facility with the three major mobile network operators all offering service.

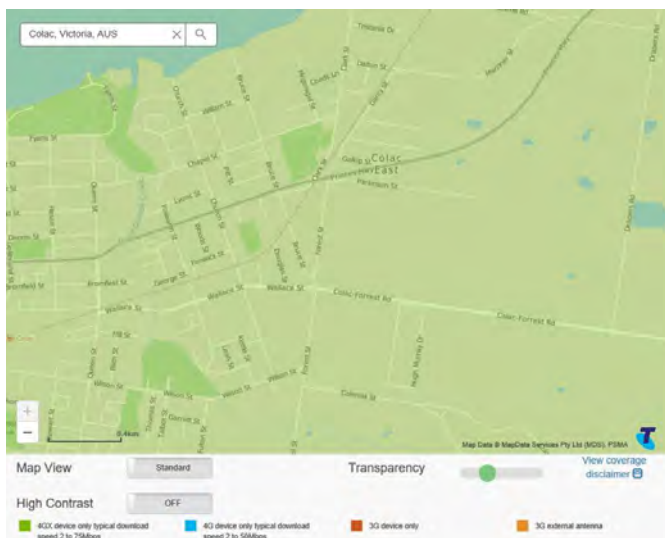


Figure 66 Telstra mobile coverage of the AKD Softwood facility

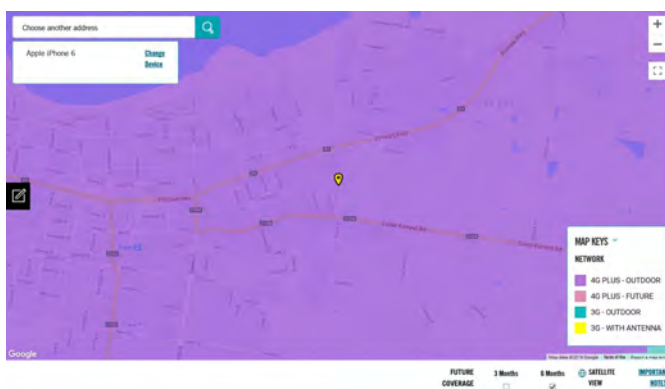


Figure 67 Optus mobile coverage of the AKD Softwood facility

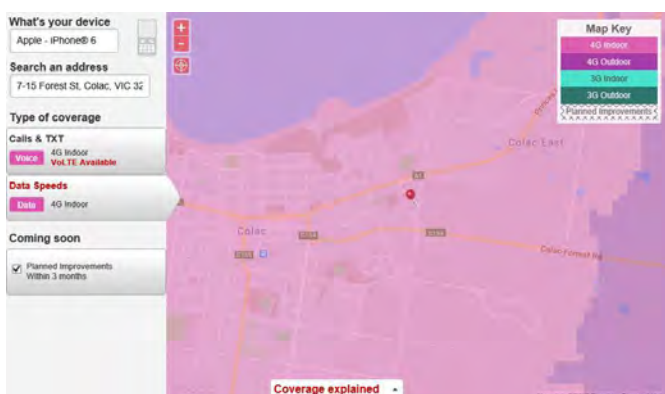


Figure 68 Vodafone mobile coverage of the AKD Softwood facility

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.

Based on these maps:

- Sigfox appears focussed on the northern and western parts of the region with national park areas marked for future rollout; and
- Taggle coverage appears to cover the entire region.

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 the needs, opportunities and barriers in the adoption of IoT technologies.

Grazing

- Dairy
- The area south-west of Colac

Taggle coverage appears to be available in the area south-west of Colac.

Sigfox maps show partial coverage is available in the area south-west of Colac.

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

Grazing

- Beef meat
- The area north of Colac

Taggle coverage appears to be available in the area north of Colac.

Sigfox maps show partial coverage is available north of Colac.

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

Poultry

- Chicken meat
- The area around Winchelsea

Taggle coverage appears to be available in the area around Winchelsea.

Sigfox maps show partial coverage is available in the area around Winchelsea.

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

Food and Fibre Processing Facility

- Scotchmans Hill Winery

- 190 Scotchmans Rd, Drysdale

Taggle coverage appears to be available at the winery.
Sigfox maps show coverage is available at the winery.
The Optus NB-IoT trials show no coverage in the area.

Food and Fibre Processing Facility

- Organic Dairy Farmers
- 62-66 Cowie St, North Geelong

Taggle coverage appears to be available at the facility.
Sigfox maps show coverage is available at the facility.
The Optus NB-IoT trials show no coverage in the area.

Food and Fibre Processing Facility

- AKD Softwood ((Forestry and Timber)
- 7-15 Forest St, Colac

Taggle coverage appears to be available at the facility.
Sigfox maps shows that coverage appears to be available but further checking is advised.
The Optus NB-IoT trials show no coverage in the area.

4.5 Skills

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

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

Across the Barwon 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 Western-most local government area, Colac-Otway, is significantly lower than for other local government areas.

LGA	Population	% Year 12+
Colac-Otway	21,436	50.7%
Greater Geelong	244,798	59.9%
Queenscliff	2,934	64.1%
Surf Coast	31,324	71.5%
Region	300,492	60.5%

5 Tourist Locations

5.1 Bells Beach

Bells Beach is a renowned surf beach located on the Great Ocean Road, near Torquay.

The beach is home to the Rip Curl Pro Surfing Competition held over the Easter Break every year. The facilities available onsite include a kiosk, first aid centre, toilets, showers and parking area.



Figure 69 Surfer overlooking Bells Beach¹⁴

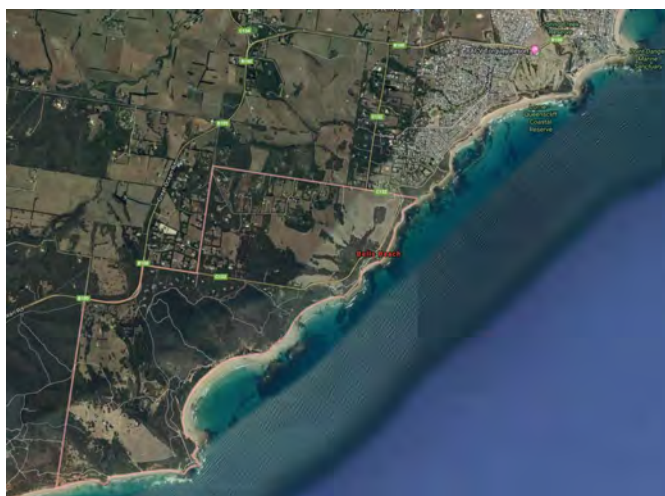


Figure 70 Aerial imagery of Bells Beach

Fixed Broadband

Our analysis reveals Bells Beach falls into the NBN FTTN fixed line footprint, extending from the town of Jan Juc.

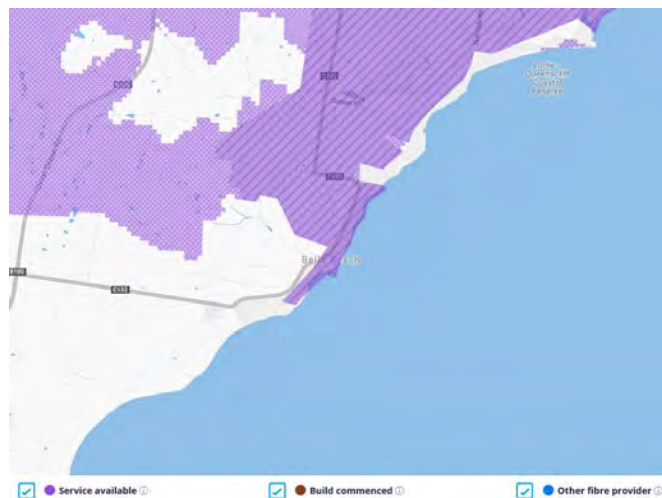


Figure 71 NBN Coverage of Bells Beach (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows partial 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the beach. During 2017, the Commonwealth Mobile Black Spots Program and Telstra announced an agreement to construct a 4G small cell at Bells Beach. This cell is expected to come online during 2019.
- Optus shows 4G Plus outdoor coverage of the beach
- Vodafone shows 4G indoor coverage of the beach.

In summary, there appears to be 4G coverage of the beach from two of the three mobile network operators with partial coverage from the third (coverage planned for 2019).

¹⁴ <https://www.visitmelbourne.com/regions/Great-Ocean-Road/Things-to-do/Nature-and-wildlife/Beaches-and-coastlines/VV-Bells-Beach#>

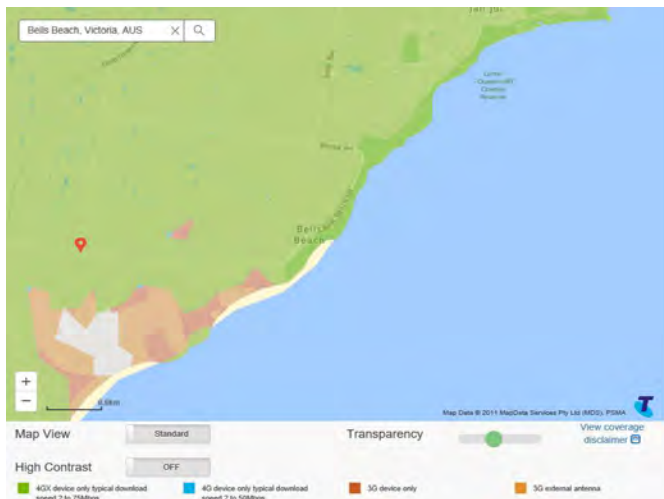


Figure 72 Telstra mobile coverage of Bells Beach

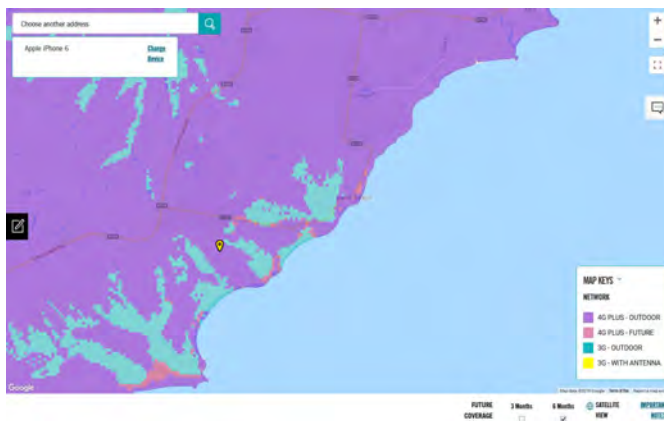


Figure 73 Optus mobile coverage of Bells Beach

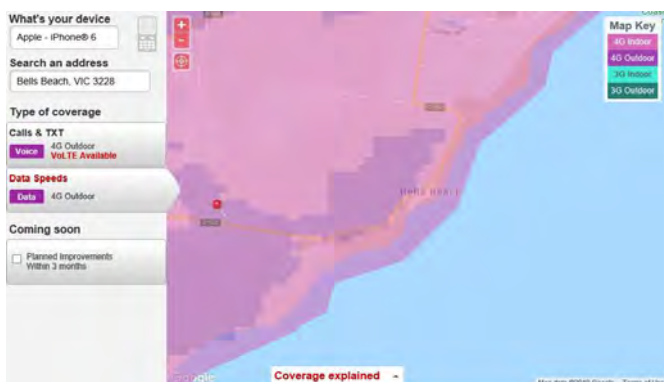


Figure 74 Vodafone mobile coverage of Bells Beach

5.2 Johanna Beach

Johanna Beach is a popular surfing spot located in Great Otway National Park. The Great Ocean Road provides access to the beach and the camping ground situated behind the sand dunes of the beach.

There are 25 unpowered campsites available to book throughout the year. Non-flush toilets are available

and visitors are advised to supply their own water as no drinking water is available on site.

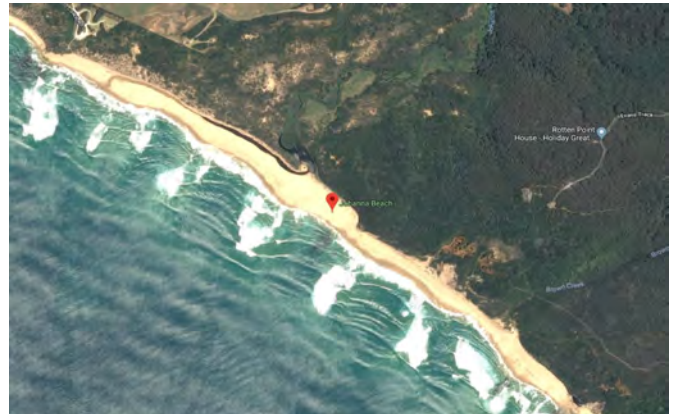


Figure 75 Aerial imagery of Johanna Beach

Fixed Broadband

Our analysis reveals that Johanna Beach falls within the NBN satellite footprint.

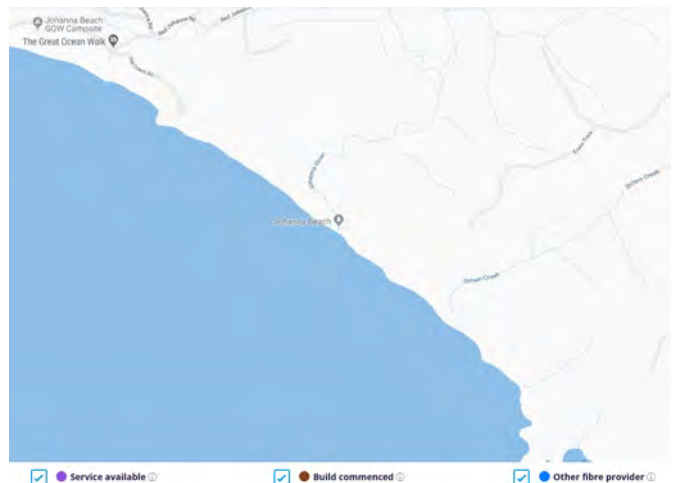


Figure 76 NBN Coverage of Johanna Beach (NBN Co)

Mobile Coverage

Based on public coverage maps:

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

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



Figure 77 Telstra mobile coverage of Johanna Beach

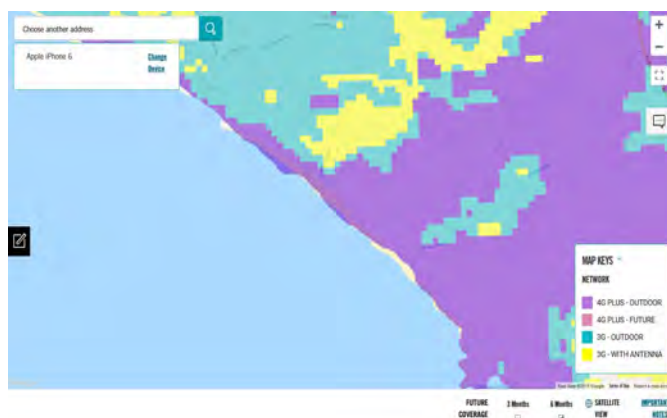


Figure 78 Optus mobile coverage of Johanna Beach



Figure 79 Vodafone mobile coverage of Johanna Beach

5.3 The Blues Train Queenscliff

The Blues Train is a unique music experience that rides along the Bellarine Railway. The shows takes place every Saturday night.

The musical journey begins and ends in Queenscliff with intervals at Suma Park platform and Drysdale Station. The night includes four musical performances of 30 minutes each on four different carriages. Patrons change carriages at each interval to ensure all acts are seen on the night.



Figure 80 Patrons on the Blues Train Queenscliff¹⁵

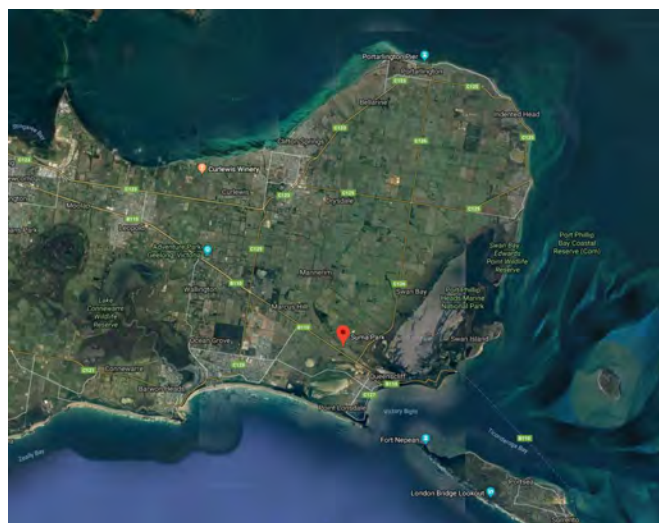


Figure 81 Aerial imagery of the Blues Train Queenscliff route

Fixed Broadband

Our analysis reveals Queenscliff and Drysdale is predominately serviced by NBN FTTN within the fixed line footprint. Suma Park platform is serviced by NBN satellite.

¹⁵ <https://www.thebluestrain.com.au/blog/>

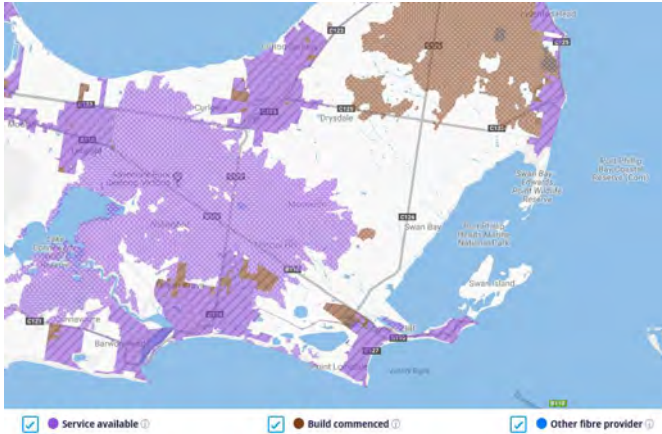


Figure 82 NBN Coverage of Queenscliff, Suma Park and Drysdale (NBN Co)

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 rail journey
- Optus shows 4G Plus outdoor coverage of the rail journey
- Vodafone shows 4G indoor and 4G outdoor coverage of the rail journey.

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



Figure 83 Telstra mobile coverage of Blues Train Queenscliff

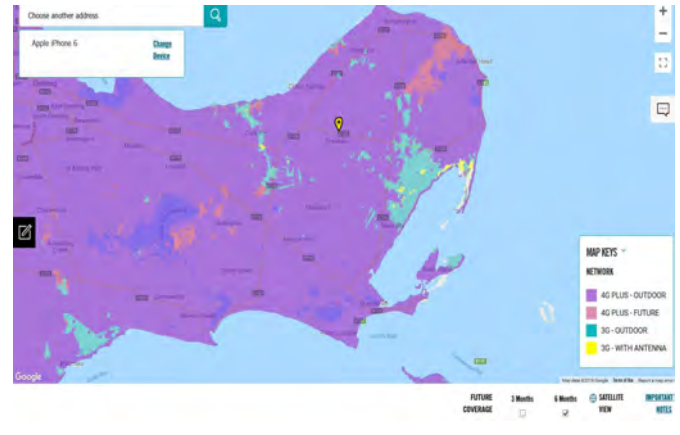


Figure 84 Optus mobile coverage of Blues Train Queenscliff

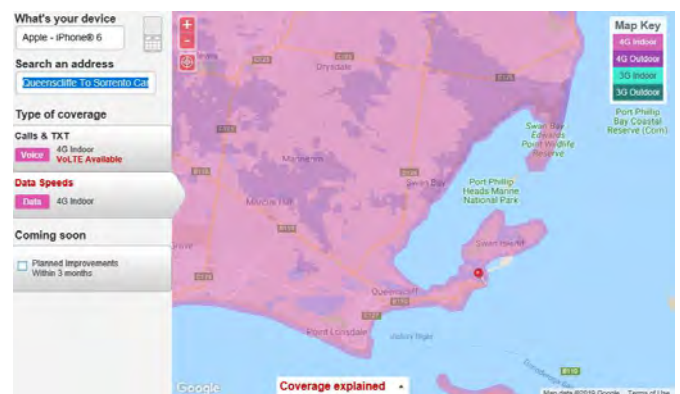


Figure 85 Vodafone mobile coverage of Blues Train Queenscliff

5.4 Marriner's Lookout

Marriner's Lookout is located north of Apollo Bay, at the top of a hill with views of the ocean, town and hinterland.

The view can be reached by a 10-minute walk from the carpark. For a more strenuous walk, a 1.5 kilometre track from Apollo Bay to the lookout is an option. The lookout is a popular take off destination for hang gliders.



Figure 86 View from Marriner's Lookout¹⁶

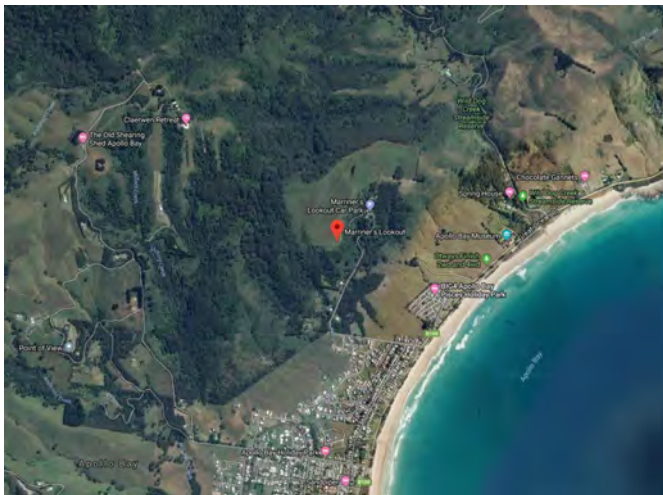


Figure 87 Aerial imagery of Marriner's Lookout

Fixed Broadband

Our analysis reveals the Marriner's Lookout falls within the NBN satellite footprint. Further analysis shows NBN FTTN fixed line is servicing south and east of the lookout.

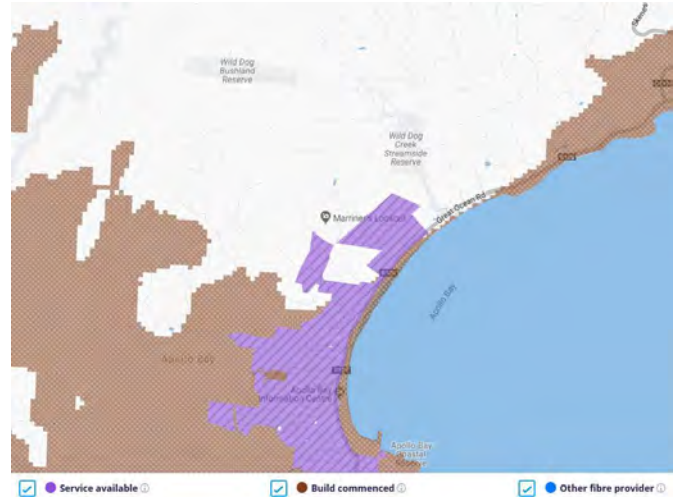


Figure 88 NBN Coverage of Marriner's Lookout (NBN Co)

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 coverage of the lookout
- Vodafone shows 4G indoor coverage of the lookout.

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

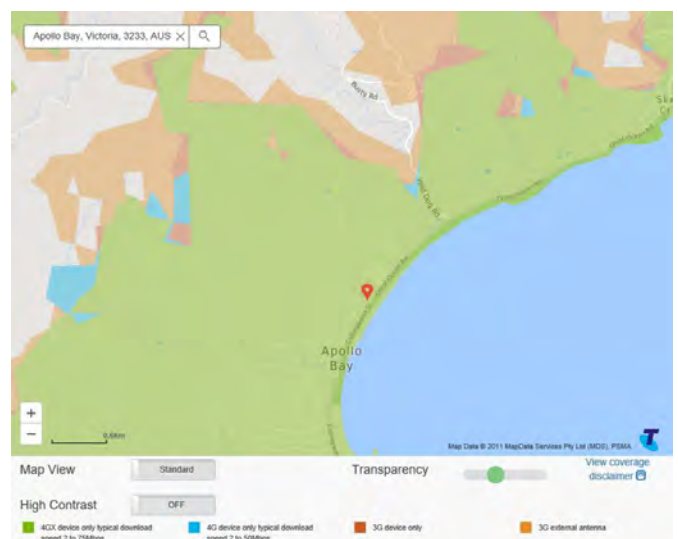


Figure 89 Telstra mobile coverage of Marriner's Lookout

¹⁶ <http://www.apollobay.com.au/places/mariners-lookout/>



Figure 90 Optus mobile coverage of Marriner's Lookout

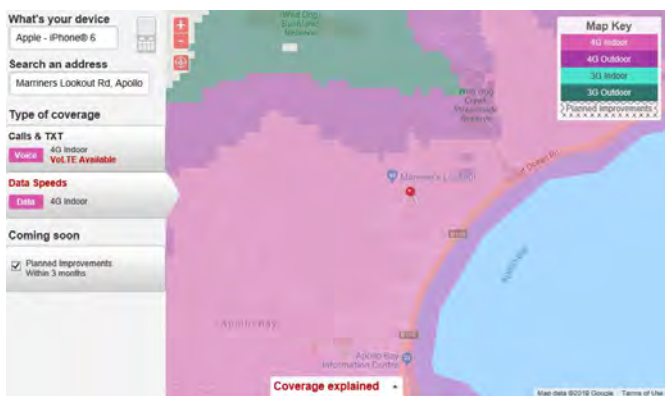


Figure 91 Vodafone mobile coverage of Marriner's Lookout

5.5 Jirrahlinga Koala and Wildlife Sanctuary

The Jirrahlinga Koala and Wildlife Sanctuary, located in Barwon Heads, was established more than 30 years ago as a haven for injured wildlife.

The 5-acre sanctuary houses rescued animals visited by many people including those that have physical and mental limitations.

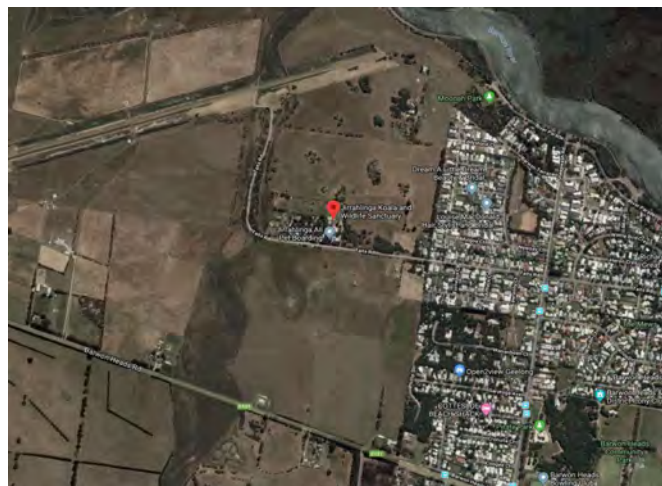


Figure 92 Aerial imagery of the Jirrahlinga Koala and Wildlife Sanctuary

Fixed Broadband

Our analysis reveals the Jirrahlinga Koala and Wildlife Sanctuary falls into the NBN satellite footprint, directly adjacent to the NBN FTTN fixed line footprint.



Figure 93 NBN Coverage of the sanctuary (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 sanctuary
- Optus shows 4G Plus outdoor coverage of the sanctuary
- Vodafone shows 4G indoor coverage of the sanctuary with improvements planned.

In summary, there appears to be 4G coverage of the Jirrahlinga Koala and Wildlife Sanctuary from the three mobile network operators.

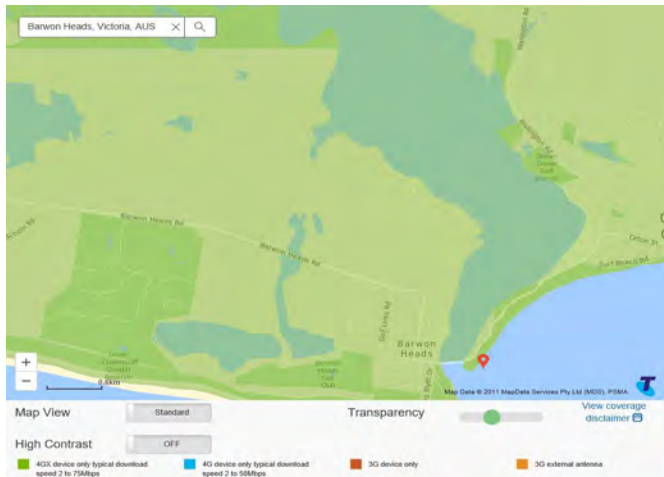


Figure 94 Telstra mobile coverage of Jirrahlinga Koala and Wildlife Sanctuary

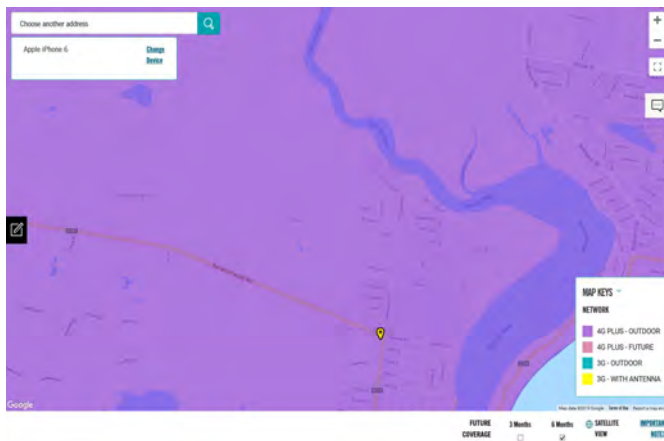


Figure 95 Optus mobile coverage of Jirrahlinga Koala and Wildlife Sanctuary

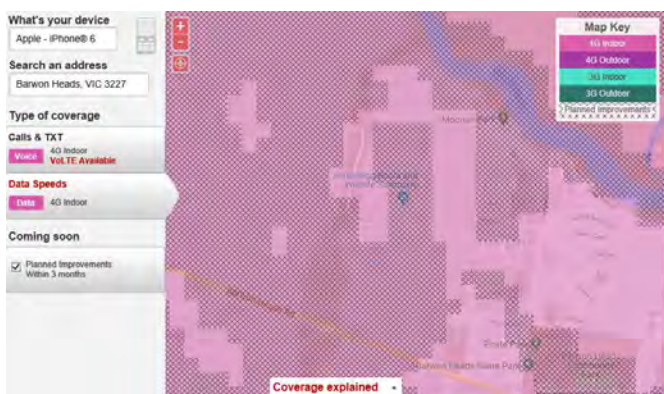


Figure 96 Vodafone mobile coverage of Jirrahlinga Koala and Wildlife Sanctuary

5.6 Kardinia Park

Kardinia Park is a sporting and entertainment venue located in South Geelong.

The park includes the GMHBA Stadium (home of the Geelong Football Club), Geelong Cricket Club and Kardinia Aquatic Centre.

The stadium is the largest stadium in a regional city, with a capacity of 34,000 people.



Figure 97 The GMHBA Stadium¹⁷

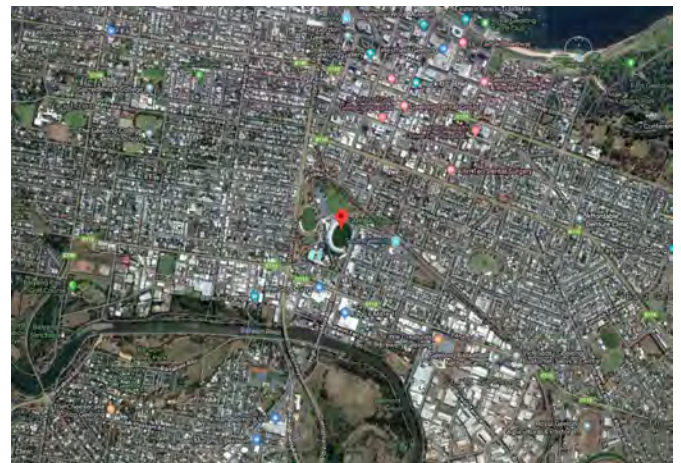


Figure 98 Aerial imagery of Kardinia Park

Fixed Broadband

Our analysis reveals Kardinia Park has NBN FTTC fixed line currently under construction (highlighted in brown stripes).

¹⁷ <http://sport.vic.gov.au/our-work/infrastructure/major-infrastructure-projects/gmhba-stadium>

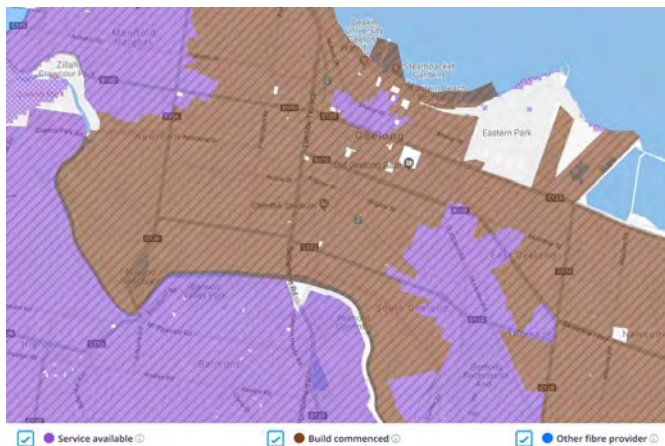


Figure 99 NBN Coverage of Kardinia Park (NBN Co)

Mobile Coverage

Based on public coverage maps:

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

In summary, there appears to be coverage in the park from the three mobile network operators however, coverage speeds and signals may be affected by the increased number of visitors to the venue.

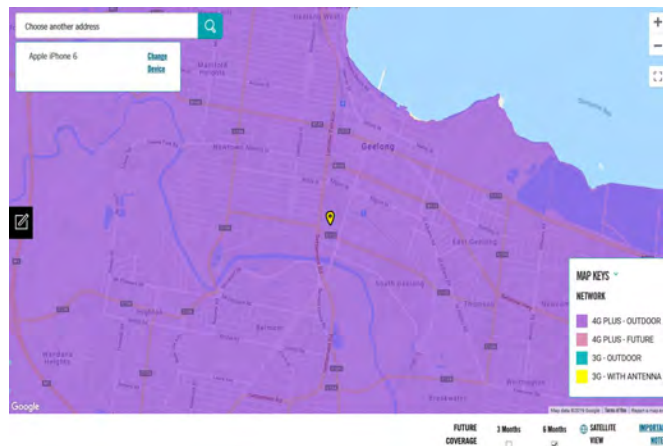


Figure 101 Optus mobile coverage of Kardinia Park

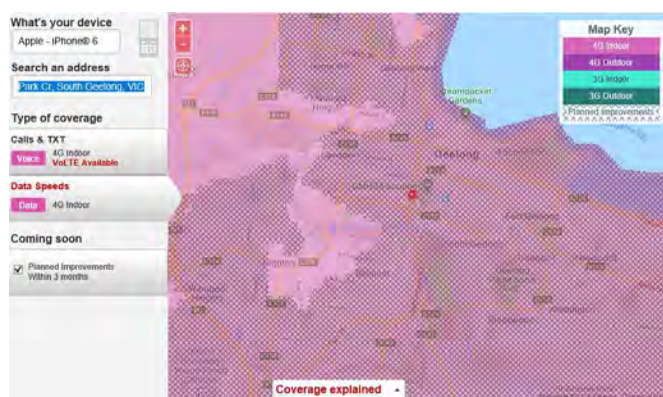


Figure 102 Vodafone mobile coverage of Kardinia Park

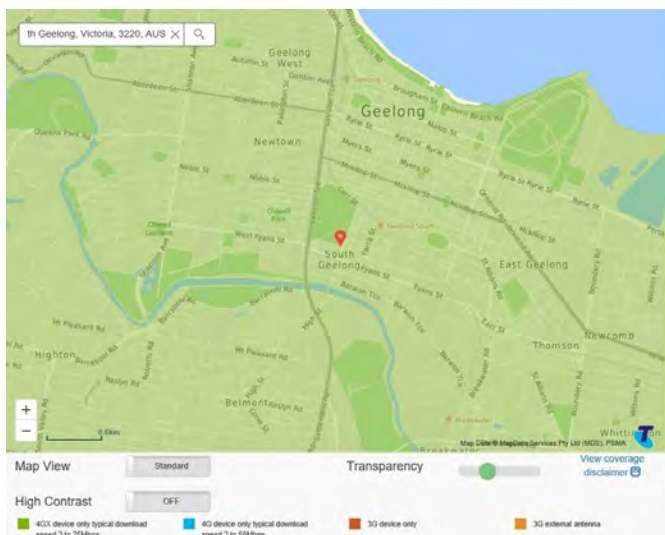


Figure 100 Telstra mobile coverage of Kardinia Park

5.7 Adventure Park

Adventure Park is Victoria's biggest theme park located in Wallington, a ten-minute drive from Geelong.



Figure 103 Adventure Park¹⁸

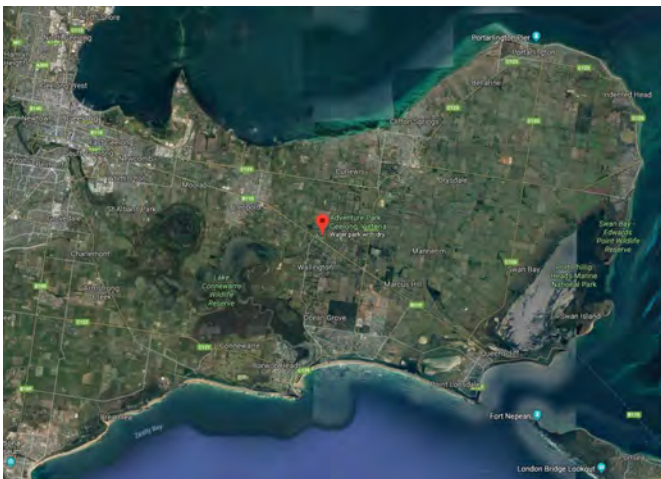


Figure 104 Aerial imagery of Adventure Park

Fixed Broadband

Our analysis reveals Adventure Park is serviced by NBN fixed wireless.

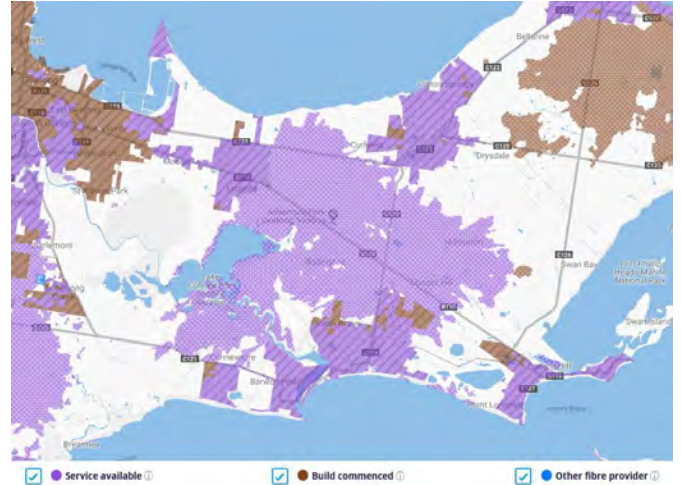


Figure 105 NBN Coverage of Adventure Park (NBN Co)

Mobile Coverage

Based on public coverage maps:

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

In summary, there appears to be coverage in the park from the three mobile network operators.

¹⁸ <https://www.adventurepark.com.au/park-info/contact-us/>

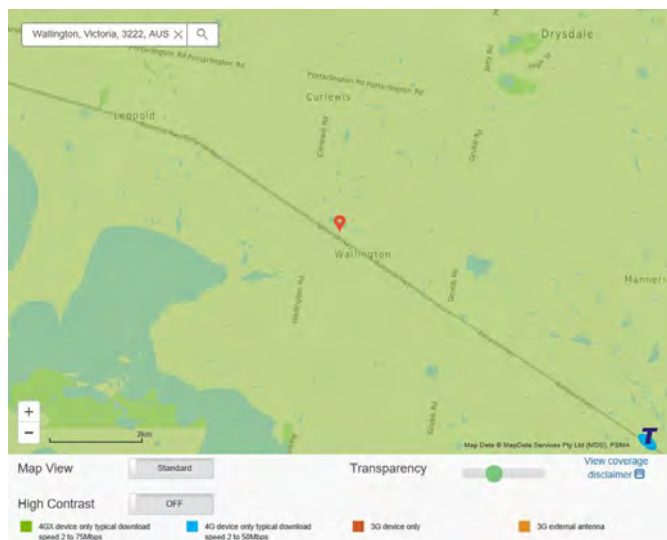


Figure 106 Telstra mobile coverage of Adventure Park

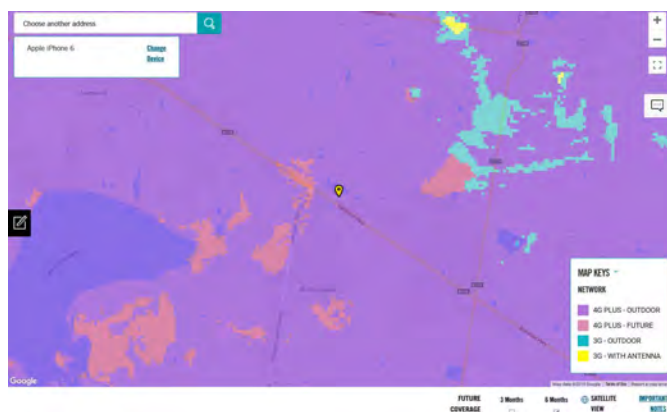


Figure 107 Optus mobile coverage of Adventure Park

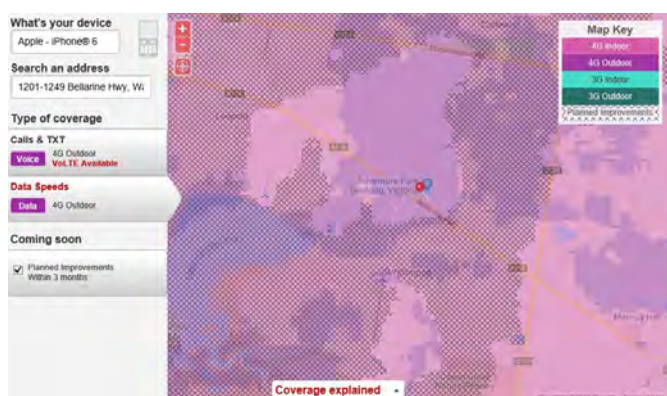


Figure 108 Vodafone mobile coverage of Adventure Park

5.8 The Great Ocean Road

The Great Ocean Road stretches from Torquay region to Yuulong within the Barwon Region. The road connects to many towns, attractions, trails and walks

including the Cape Otway National Park, Surf Coast Walk, Bells Beach and Lorne (and many more).



Figure 109 Great Ocean Road between Torquay and the western edge of the Colac Otway LGA

Fixed Broadband

Refer to Significant Places for fixed broadband analysis of towns accessible from Great Ocean Road. These include Torquay, Jan Juc, Anglesea, Aireys Inlet, Fairhaven, Lorne and Apollo Bay. The towns are largely serviced by NBN FTTN fixed line, enabling visitors and businesses access to better quality broadband services.

Mobile Coverage

Based on public coverage maps:

- Telstra provides particularly poor coverage between Lorne and Yuulong as well as the coastal section around Separation Creek but otherwise shows relatively consistent 4GX outdoor coverage
- Optus similarly shows particularly poor coverage from Lorne; however, Optus is constructing new coverage around Kennet River and near Beech Forest that will improve coverage via the Cape Otway National Park
- Vodafone shows no coverage between Apollo Bay and Yuulong via the Cape Otway National Park as well significant black spots between Kennett River and Lorne, but otherwise shows 4G outdoor coverage across the route.

In summary, there appears to be unreliable mobile coverage for all three mobile network operators across significant sections of the route.

Refer to Significant Places for mobile coverage analysis in each of the towns accessible from the

road. In summary, it appears visitors have good options for coverage in the towns along the route.

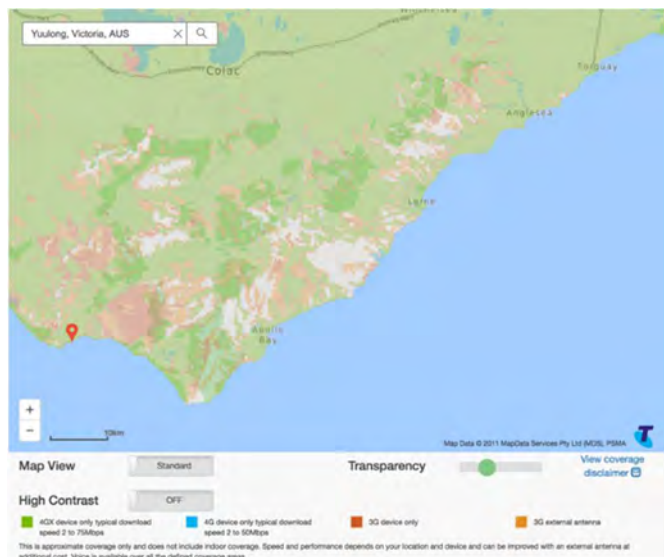


Figure 110 Telstra mobile coverage between Torquay and the western edge of the Colac Otway LGA

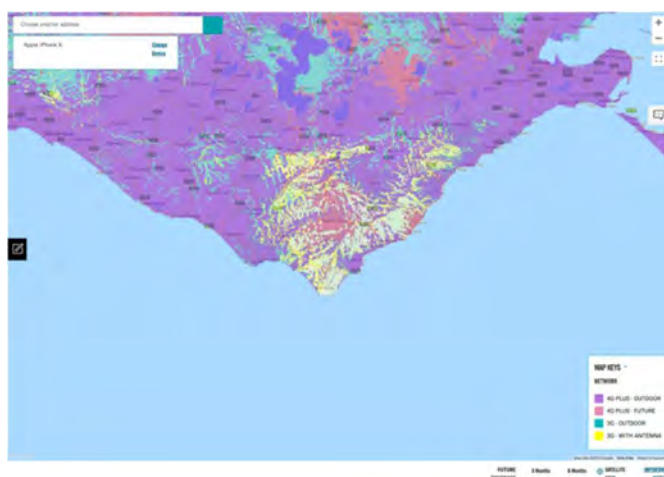


Figure 111 Optus mobile coverage between Torquay and the western edge of the Colac Otway LGA

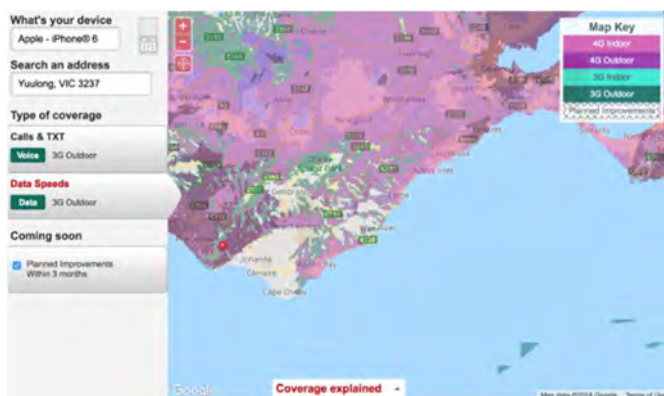


Figure 112 Vodafone mobile coverage between Torquay and the western edge of the Colac Otway LGA

5.9 The Falls Music and Arts Festival

The Falls Music and Arts Festival, better known as Falls Festival, is an annual music festival that runs for four days over the New Year period off the small coastal town of Lorne. The festival was established in 1993 and travels through three other cities in Australia – Byron Bay in New South Wales, Fremantle in Western Australia and Marion Bay in Tasmania.

The festivals are located at a unique venue close to the beach. In Lorne, it is traditionally held 10 kilometres from the town centre at 985 Erskine Falls Rd, Lorne VIC within the Otway Rainforest.



Figure 113 Aerial imagery of Falls Festival Lorne Venue

The festival aims to bring together music and the arts in natural settings, hosting a range of performances, including music, dance, comedy, theatre, circus, cabaret, and other art forms. Falls Festival Lorne is in its 27th year in 2019/2020 and attracts some 16,500 people to its venue and surrounding regions.



Figure 114 Stage and crowds at Falls Festival

Fixed Broadband

Our analysis reveals that the Falls Festival venue and surrounding area falls into the NBN satellite footprint. While just 10 kilometres away, the town of Lorne is serviced by NBN FTTN fixed line throughout the town and right along the coast.

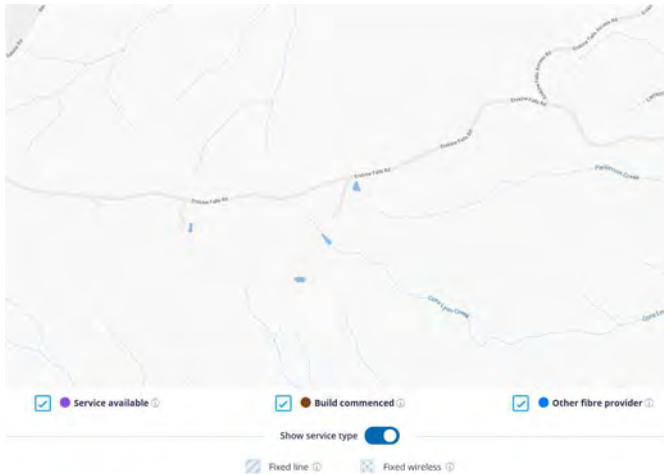


Figure 115 NBN Coverage of Falls Festival in Lorne (NBN Co)

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 area
- Optus shows a combination of 4G Plus outdoor and 3G outdoor coverage across the area
- Vodafone shows majority 4G outdoor coverage and some 3G outdoor coverage across the area.

In summary, there appears to be coverage in the area, with the three major mobile network operators all offering service however, coverage speeds and signals may be affected by the increased number of visitors to the area.

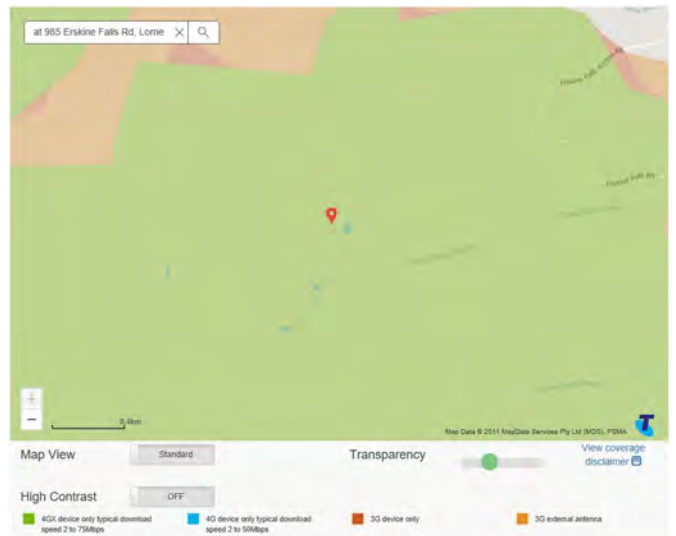


Figure 116 Telstra mobile coverage of Festival Venue

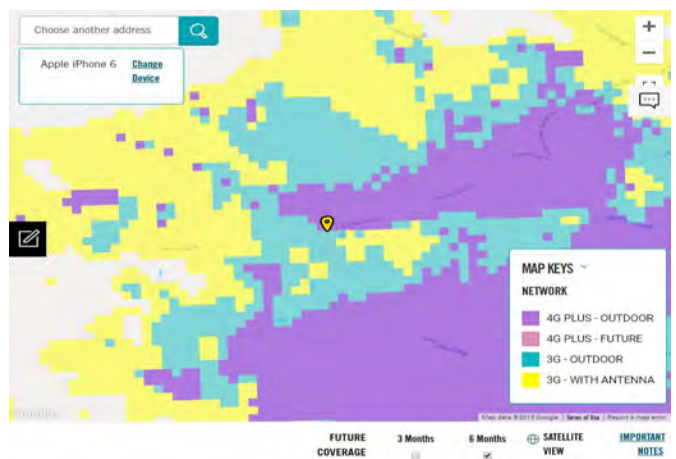


Figure 117 Optus mobile coverage of Festival Venue

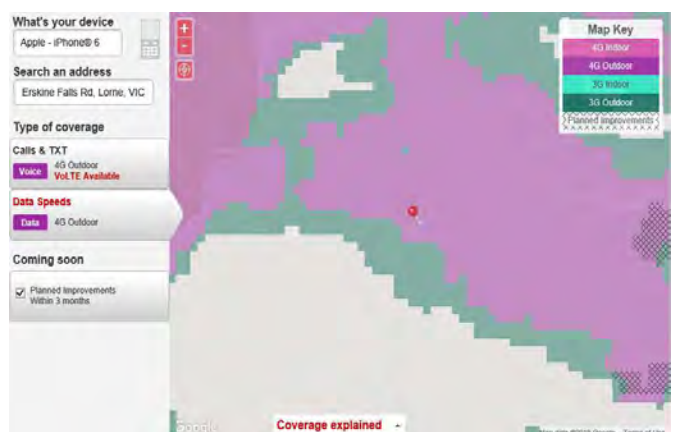


Figure 118 Vodafone mobile coverage of Festival Venue

5.10 Festival of Sails

The Festival of Sails is a three-day annual keel boat regatta held across the Geelong waterfront, consisting of the Regatta and a free community Waterfront

Festival. The Regatta Village Precinct is hosted by the Royal Geelong Yacht Club, and the waterfront entertainment and activities are held along Eastern Beach and Eastern Beach Reserve.



Figure 119 Geelong waterfront and Royal Geelong Yacht Club

The event has become an icon as one of the nation's oldest sporting events and in current years, hosts over 300 yacht entries and 3,000 competitors. It celebrated its 176th anniversary in 2019 and is held over the Australia day weekend. The festival attracts crowds of approximately 200,000 to the Geelong waterfront.



Figure 120 Waterfront festival crowds and entertainment¹⁹

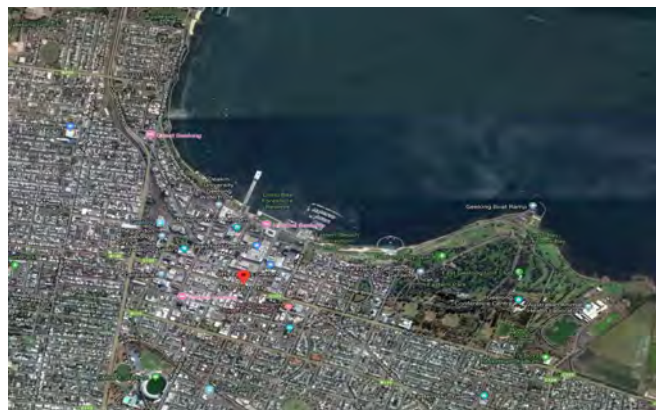


Figure 121 Aerial imagery of the Geelong Waterfront

Fixed Broadband

Our analysis reveals that the Festival of Sails venue and much of the surrounding area will fall into an area that will eventually be serviced by NBN FTTN fixed line. Apart from the Corio Bay foreshore and the Eastern Park in the area, the build has commenced for the Eastern Beach foreshore and surrounding areas. Small patches in the surrounding area are already serviced by NBN FTTN fixed line or fixed wireless technologies.

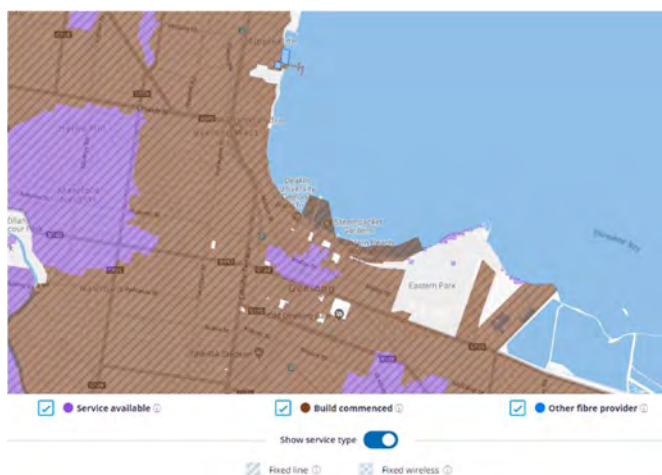


Figure 122 NBN Coverage of the Festival of Sails in Geelong (NBN Co)

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 venue

¹⁹ <https://festivalofsails.com.au/australia-day-and-day-one-of-the-iconic-festival-of-sails>

- Optus shows 4G Plus outdoor coverage across the venue
- Vodafone shows 4G indoor coverage across the venue with improvements planned.

In summary, there appears to be coverage in the area, with the three major mobile network operators all offering service however, coverage speeds and signals may be affected by the increased number of visitors to the area.



Figure 123 Telstra mobile coverage of Festival Venue

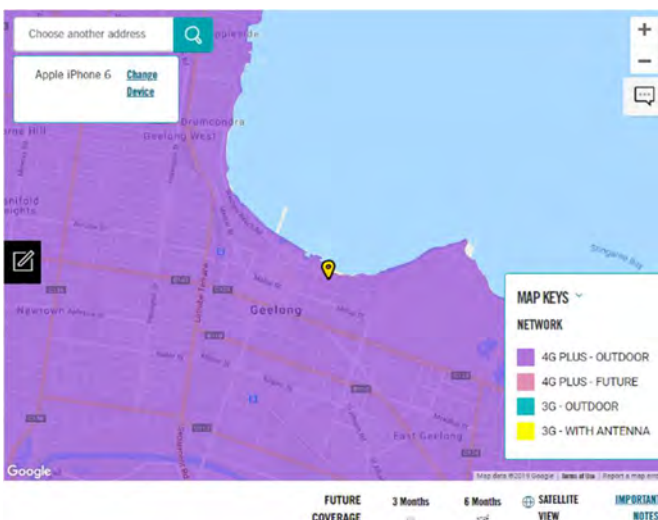


Figure 124 Optus mobile coverage of Festival Venue

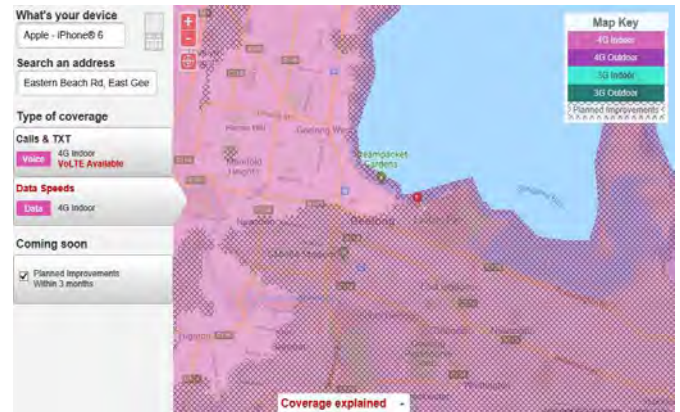


Figure 125 Vodafone mobile coverage of Festival Venue

5.11 Portarlington Mussel Festival

The Portarlington Mussel Festival is held in Portarlington on the Bellarine Peninsula on the second Saturday of January every year.

Mussels are the theme for the day with food and drink stalls, live entertainment, kids' entertainers, art and photo exhibitions, cooking demonstrations and classic car displays are also featured throughout the day.



Figure 126 Performance at the Portarlington Mussel Festival²⁰

²⁰<https://www.geelongaustralia.com.au/events/calendar/item/8d64fc11a854af6.aspx>

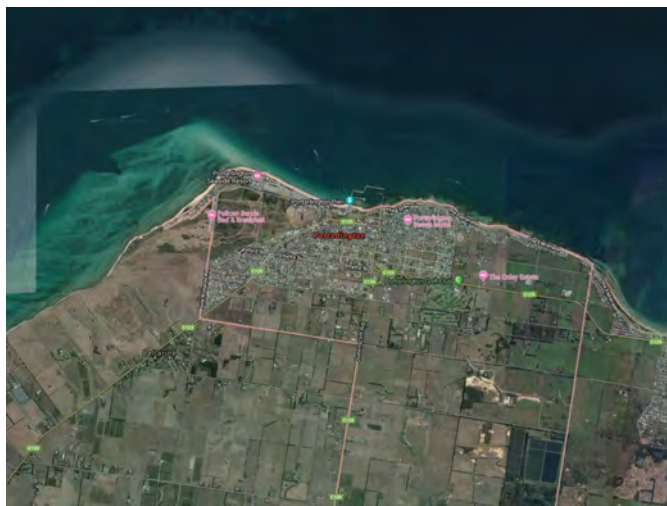


Figure 127 Aerial imagery of Portarlington

Fixed Broadband

Refer to Significant Places for fixed broadband analysis of Portarlington on page 78.

Mobile Coverage

Refer to Significant Places for mobile coverage analysis of Portarlington on page 78.

5.12 The Gellibrand River Blues and Blueberry Festival

The Gellibrand River Blues and Blueberry Festival is a two-day event held annually on the last Saturday and Sunday of February.

On the Saturday, some of Australia's best Blues Bands play at the Blues Music Festival which is held at the Otway Tourist Park at Gellibrand River.

On the Sunday, markets featuring local produce including blueberries and blueberry products are open at the Rex Norman Reserve. Local entertainment, arts

and craft displays, and kids' activities are also provided at the festival.



Figure 128 Blues band playing at the festival²¹



Figure 129 Aerial imagery of the Otway Tourist Park and Rex Norman Reserve

Fixed Broadband

Our analysis reveals the Otway Tourist Park and Rex Norman Reserve is serviced by NBN fixed wireless.

²¹ <http://www.bluesandblueberryfestival.com.au/>

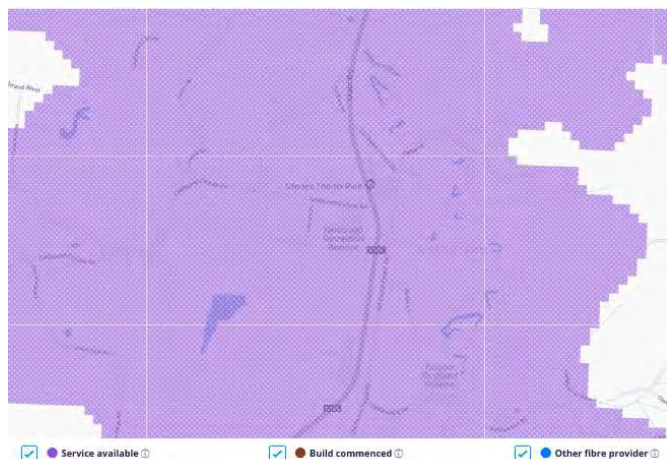


Figure 130 NBN Coverage of the Gellibrand River Blues and Blueberry Festival venues (NBN Co)

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 venues
- Optus shows 3G outdoor coverage of the venues
- Vodafone shows no coverage of the venues.

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

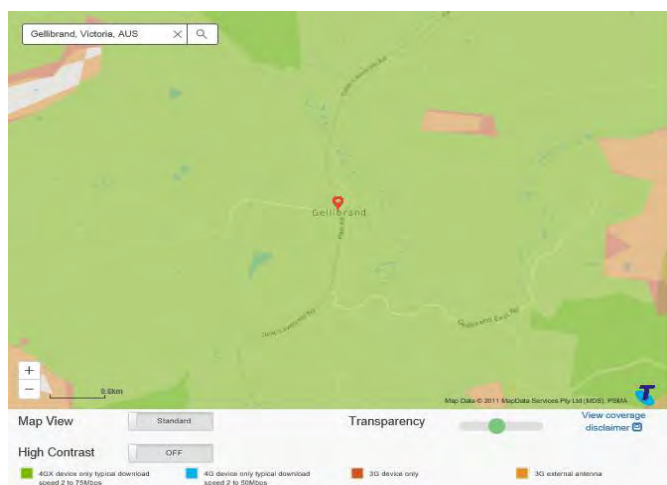


Figure 131 Telstra mobile coverage of the Gellibrand River Blues and Blueberry Festival



Figure 132 Optus mobile coverage of the Gellibrand River Blues and Blueberry Festival

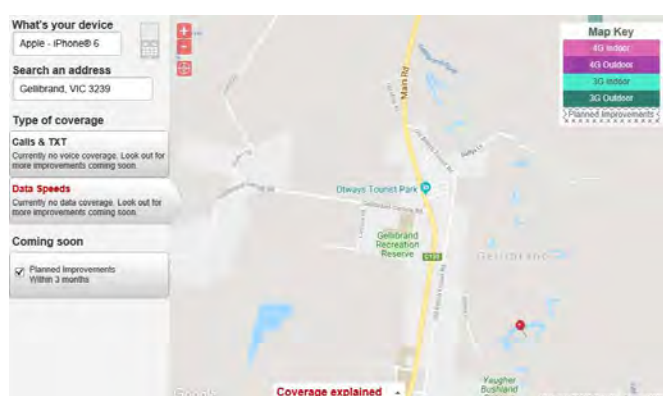


Figure 133 Vodafone mobile coverage of the Gellibrand River Blues and Blueberry Festival

5.13 The Great Ocean Walk

The Great Ocean Walk is a 100 kilometre coastal walk, in its entirety, from Apollo Bay to Twelve Apostles with the route from Apollo Bay to around Wattle Hill falling into the Barwon Region.

The difficulty of the walk increases as you travel towards Twelve Apostles. Shorter walks are available with access points at Blanket Bay, Cape Otway and Milanesia Beach. If a multiday journey is chosen, on trail campsites, B&B's, hotels and lodge accommodation are available.



Figure 134 Walkers on their walk in Apollo Bay on the Great Ocean Walk²²



Figure 135 Map of the Great Ocean Walk²³

Fixed Broadband

Our analysis reveals the town of Apollo Bay is largely serviced by NBN FTTN fixed line including the Apollo Bay Information Centre.

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 from Apollo Bay to Shelley Beach. The inland walk between Shelly Beach and Blanket Bay has 4GX and 3G device coverage with blackspots evident. 4GX and 3G device coverage is shown on the remainder of the walk (within the Barwon region).

- Optus shows 4G Plus outdoor coverage from Apollo Bay to Shelly Beach. 4G Plus and 3G outdoor coverage is shown for the remainder of the walk with small blackspots evident.
- Vodafone shows 4G indoor and outdoor coverage from Apollo Bay to Shelly Beach. 4G outdoor and 3G outdoor coverage is shown from Shelly Beach to close to Cape Otway with no coverage shown for the remainder of the walk (within the Barwon region).

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

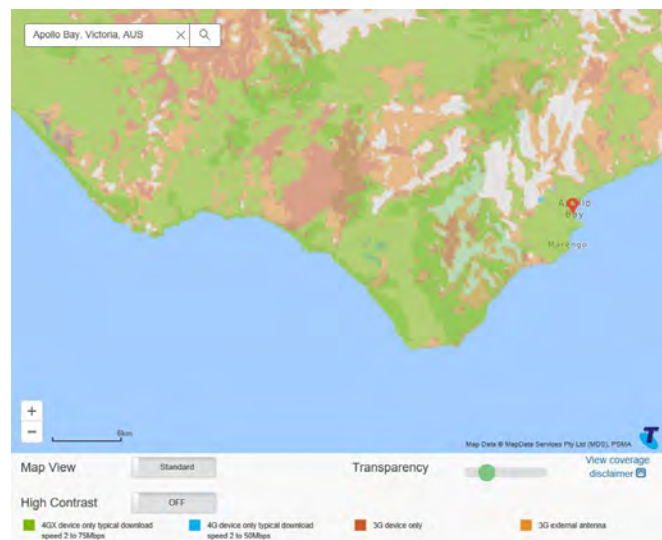


Figure 136 Telstra mobile coverage of Great Ocean Walk



Figure 137 Optus mobile coverage of Great Ocean Walk

²² <https://www.visitapollobay.com/great-ocean-walk/tours-and-services/>

²³ <https://www.greatoceanwalk.com.au/>

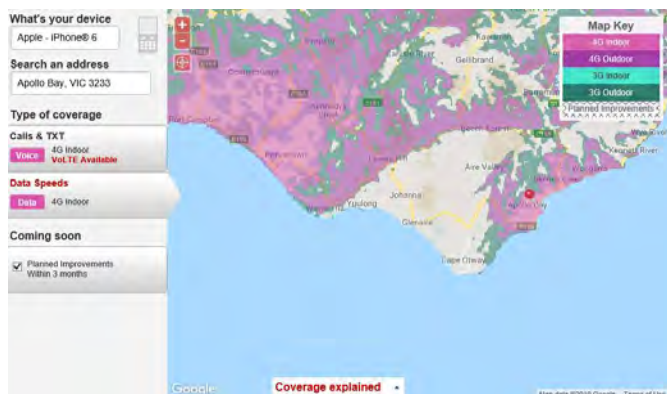


Figure 138 Vodafone mobile coverage of Great Ocean Walk



Figure 140 Surf Coast Walk²⁴

5.14 Surf Coast Walk

The Surf Coast Walk is a 44 kilometre journey, by foot or by bike, along the coastline from Point Impossible to Fairhaven.

The full length of the trail can be tackled otherwise sections of the trail can be explored. The trail is divided into 12 distinct sections with access to the entry point of each section from a carpark.

There are many highlights on the route including the iconic Bells Beach, Point Addis, the cliffs of Anglesea, Point Roadknight, the Split Point Lighthouse, learning about local indigenous culture on the Wathaurung Country Walk and venturing into Ironbark Basin.

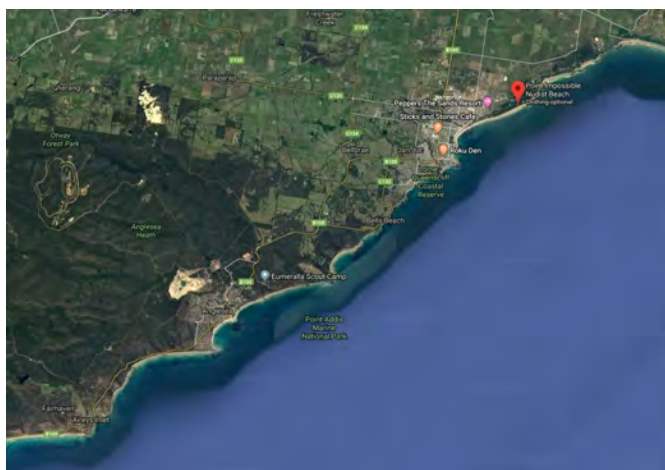


Figure 139 Aerial imagery of the Surf Coast Walk

Fixed Broadband

Refer to significant places for fixed broadband coverage analysis of Torquay, Jan Juc, Anglesea, Aireys Inlet and Fairhaven.

Mobile Coverage

Based on public coverage maps:

- Telstra shows predominately 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the walk with patches of 3G device coverage near Bells Beach
- Optus shows predominately 4G Plus outdoor coverage with patches of 3G outdoor coverage of the walk. 4G Plus is planned for parts of the sections that are currently covered by 3G outdoor.
- Vodafone shows 4G indoor and outdoor coverage of the walk.

In summary, there appears to be 4G coverage of most of the Surf Coast Walk from the three mobile network operators.

²⁴ <https://www.surfcoastwalk.com.au/walks>

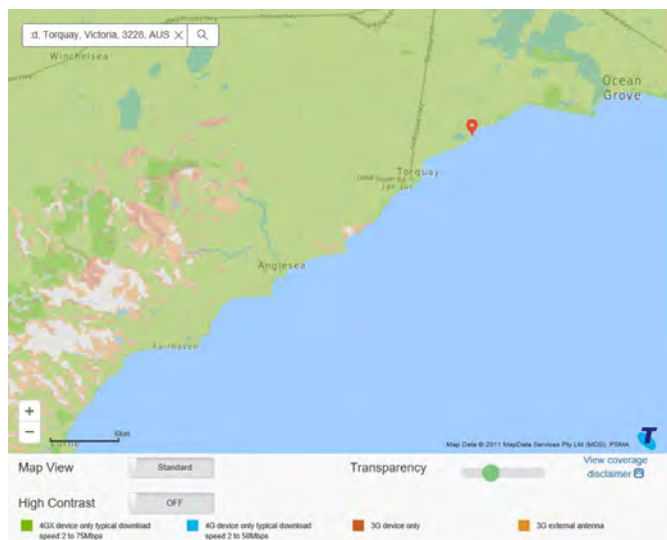


Figure 141 Telstra mobile coverage of Surf Coast Walk



Figure 142 Optus mobile coverage of Surf Coast Walk



Figure 143 Vodafone mobile coverage of Surf Coast Walk

Geelong Railway station and the Bellarine Highway, and Melaluka Road and Curlewis Road. Views of surrounding farmland and coast are seen whilst on the trail. Shelter and toilets are located on Christies Road in Leopold, Suma Park and Swan Bay Road at Mannerim.



Figure 144 Map of the Bellarine Rail Trail

Fixed Broadband

Refer to significant places for fixed broadband coverage analysis for Leopold, Queenscliff, Drysdale and Geelong.

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 predominately 4G Plus outdoor coverage of the trail with patches of 3G outdoor coverage in Curlewis
- Vodafone shows 4G indoor and outdoor coverage of the trail.

In summary, there appears to be coverage on the Bellarine Rail Trail from the three mobile network operators.

5.15 Bellarine Rail Trail

The Bellarine Rail Trail is a 32 kilometre walking and cycling track along the former South Geelong to Queenscliff railway line.

The trail travels through Leopold, Curlewis and Drysdale towns with sealed off sections between South



Figure 145 Telstra mobile coverage of the Bellarine Rail Trail

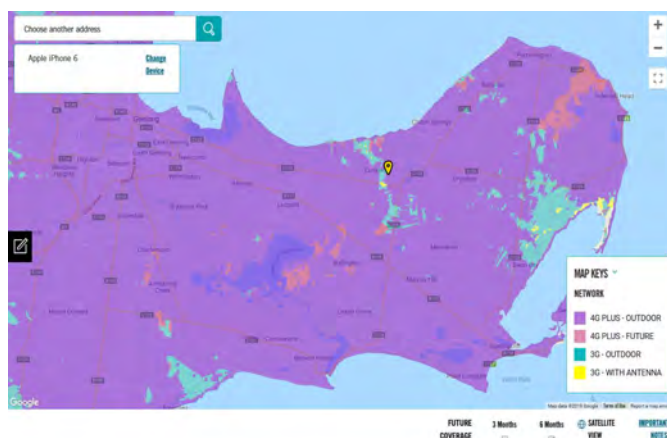


Figure 146 Optus mobile coverage of the Bellarine Rail Trail

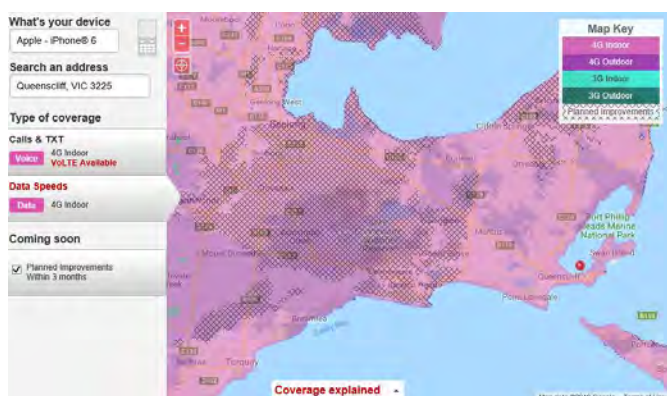


Figure 147 Vodafone mobile coverage of the Bellarine Rail Trail

5.16 Maits Rest Rainforest Walk

Maits Rest is a popular rainforest attraction in the Great Otway National Park. The attraction can be accessed from a carpark off the Great Ocean Road.

Giant myrtle beech trees create the cool temperate climate in the forest which can be seen on the 30 minute walk on gravel paths and board walk. Several types of birds exist in the rainforest, including 43 species exclusive to the rainforest.



Figure 148 The boardwalk on the Maits Rest Rainforest Walk²⁵

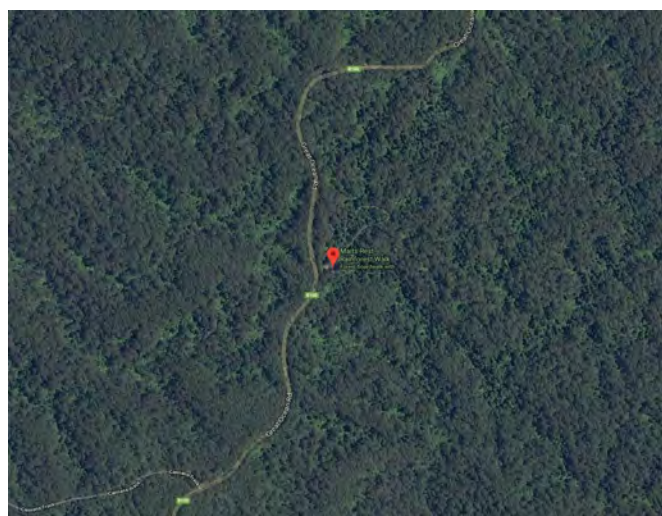


Figure 149 Aerial imagery of the Maits Rest Rainforest Walk

Fixed Broadband

Our analysis reveals the Maits Rest Rainforest falls within the NBN satellite footprint.

²⁵ <https://www.visitvictoria.com/Regions/Great-Ocean-Road/Things-to-do/Outdoor-activities/Walking-and-hiking/VV-Maits-Rest-Rainforest-Trail.aspx>



Figure 150 NBN Coverage of the Maits Rest Rainforest (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows no coverage of the walk with partial 3G device coverage on Great Ocean Road leading to the walk
- Optus shows no handheld coverage of the walk
- Vodafone shows no coverage of the walk and Great Ocean Road leading to the carpark and walk.

In summary, there appears to be poor or no coverage of the walk from the three mobile network operators.

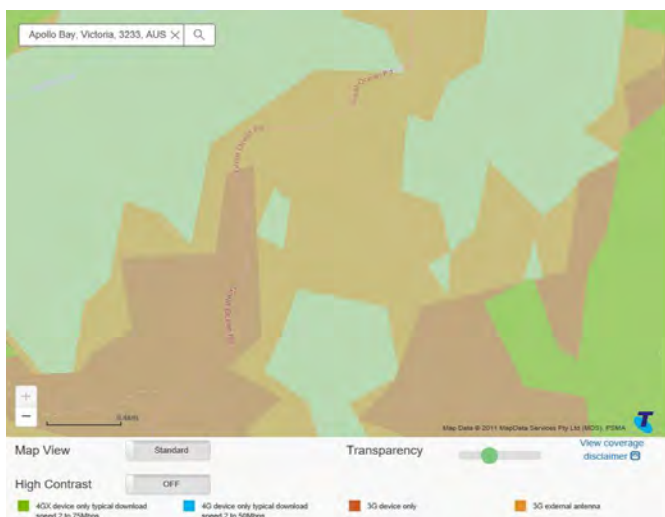


Figure 151 Telstra mobile coverage of the Maits Rest Rainforest Walk



Figure 152 Optus mobile coverage of the Maits Rest Rainforest Walk

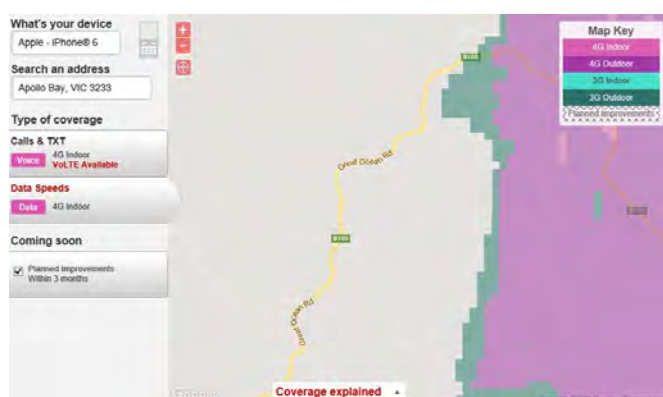


Figure 153 Vodafone mobile coverage of the Maits Rest Rainforest Walk

5.17 Forrest Mountain Bike Trail

The Forrest Mountain Bike Trails are located in the Great Otway National Park, north and south of the town of Forrest. The six trails in the south are accessed from the Forrest-Birregurra Road. The north trail is a short drive from the town, accessed via Boundary Road.

All trails can be accessed from the town on the bike. The Forrest Loop Trail is used to enter the southern trails and Forrest- Birregurra Tiger Rail Trail is used to enter the northern trails via Tiger Loop Trail.

In total, there are 16 single track trails over 65 kilometres in length for beginner and experienced riders.

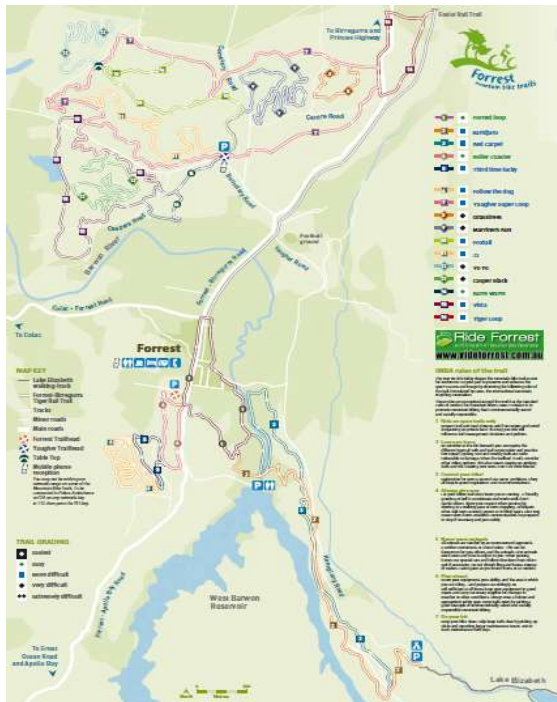


Figure 154 Map of the trails²⁶

Fixed Broadband

Our analysis reveals the town of Forreth and surrounding area is serviced by NBN fixed wireless.

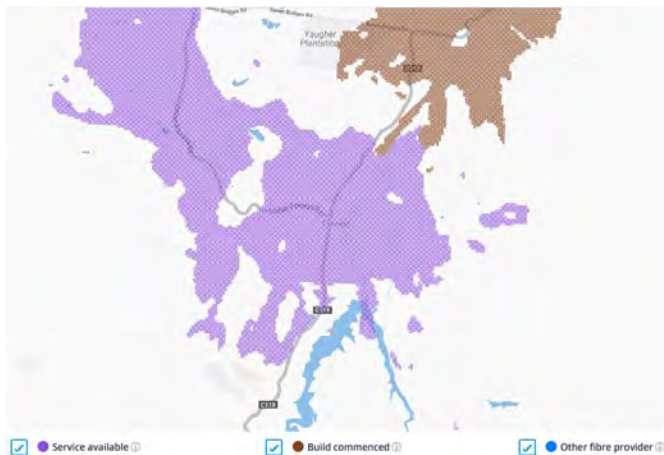


Figure 155 NBN Coverage of Forreth and surrounding area (NBN Co)

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) coverage of the northern trails. The southern trails have similar 4GX coverage, however there is 3G device coverage and a blackspot evident on the Lake Elizabeth Walking Track.
- Optus shows 4G Plus outdoor coverage of the northern trail. The southern trail has predominately 4G Plus outdoor coverage with 3G outdoor further south and very limited coverage on the Lake Elizabeth Walking Track.
- Vodafone shows no coverage of the town of Forreth. The northern and southern trails have partial 3G outdoor and 4G outdoor coverage.

In summary, there appears to be coverage on the trails from two of the mobile network operators with limited coverage from the third operator.

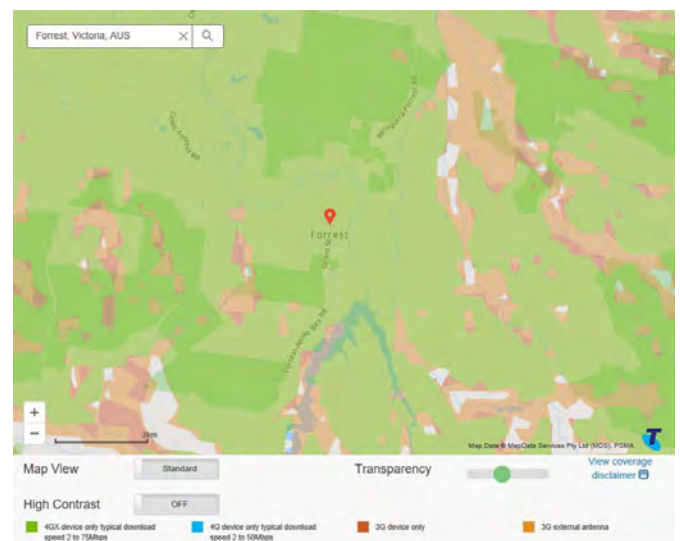


Figure 156 Telstra mobile coverage of the Forreth Mountain Bike Trails

²⁶ <https://www.forrethirebikes.com.au/gallery>

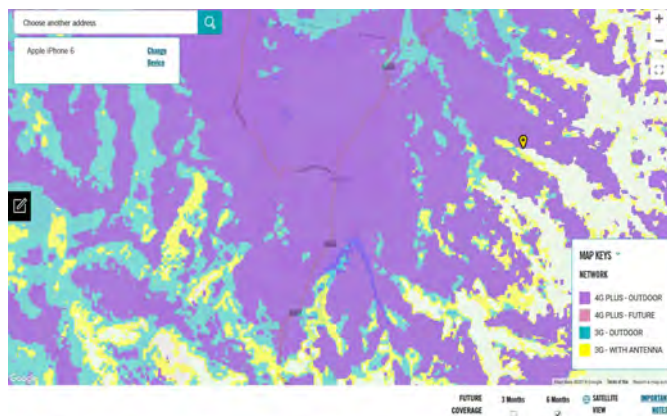


Figure 157 Optus mobile coverage of the Forrest Mountain Bike Trails



Figure 158 Vodafone mobile coverage of the Forrest Mountain Bike Trails

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)²⁷. 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.

²⁷ “A” and “B” routes are arterial highways (classification AH). “C” routes typically link smaller population centers to larger regional centers, or roads (classification AO).

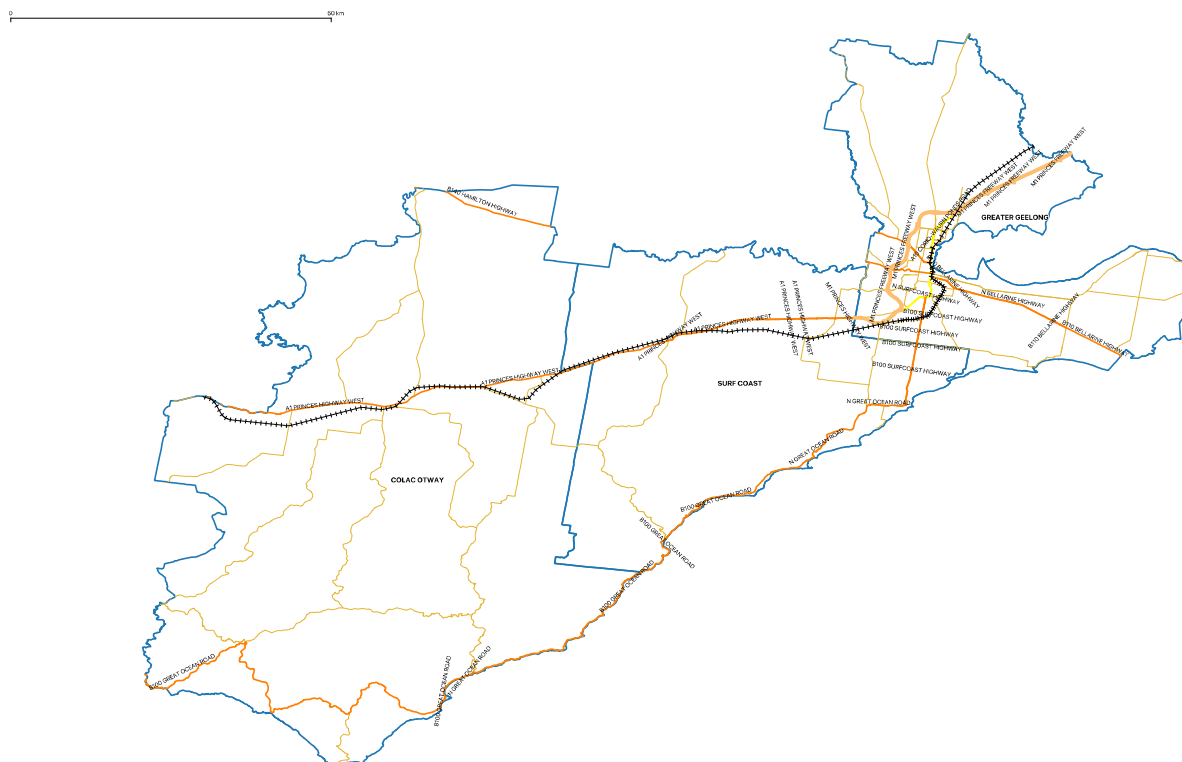


Figure 159 Barwon region declared roads

6.2 Freeways/Motorways

Practical experience of call dropouts and coverage blackspots when driving some of the roads suggests that the mobile carrier 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 with a visual scan of public carrier maps shown below.

M1 Princes Freeway West (~46 km)

- From Cocoroc near the Little River Rd interchange
- To Wauron Ponds near the Draytons Rd interchange

Maps show continuous 4G outdoor coverage or better by all three mobile network operators. Vodafone appears to be constructing significant new coverage in the Geelong area.

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	Approximate Start	Approximate End	Dist (km)
A1 PRINCES HIGHWAY WEST	Wauron Ponds	Pirron Yallock	77
A10 CORIO-WAURN PONDS ROAD	Wauron Ponds	Corio	21
A300 MIDLAND HIGHWAY	Geelong	Batesford	4
B100 GREAT OCEAN ROAD	Torquay	Yuulong	157
B100 SURFCOAST HIGHWAY	South Geelong	Torquay	18
B110 BELLARINE HIGHWAY	South Geelong	Queenscliff	30

A1 Princes Highway West (~77 km)

- From Wauron Ponds
- To Pirron Yallock

This highway connects metropolitan Melbourne to the western Victorian border and Mount Gambier. The section of the highway within the region is illustrated below.

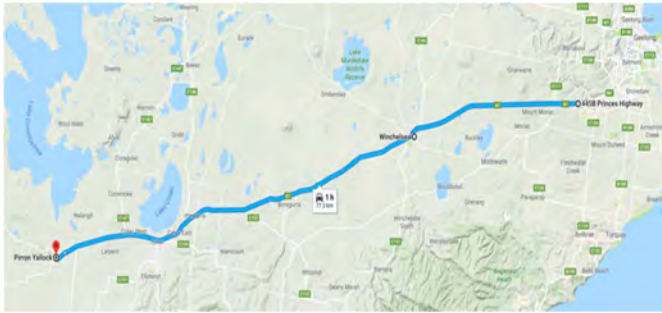


Figure 160 Section of the Princes Highway West from Waurn Ponds to Pirron Yallock (Google Maps)

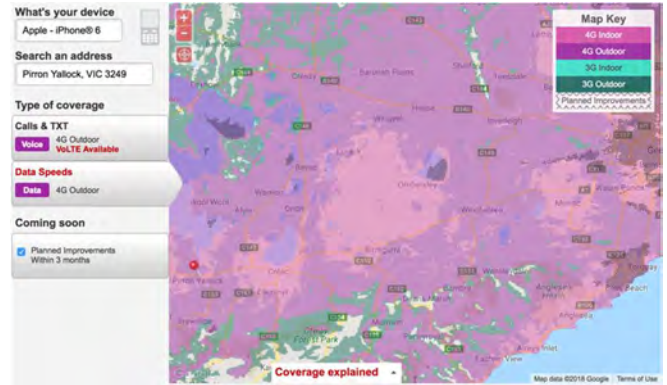


Figure 163 Vodafone mobile coverage on the section of the Princes Highway West

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

A10 Corio-Waurn Ponds Road (~21 km)

- From Waurn Ponds
- To Corio

Prior to the completion of the Geelong Ring Road in 2013, the Corio-Waurn Ponds Road formed the main Princes Freeway thoroughfare through Geelong. The highway is illustrated below.

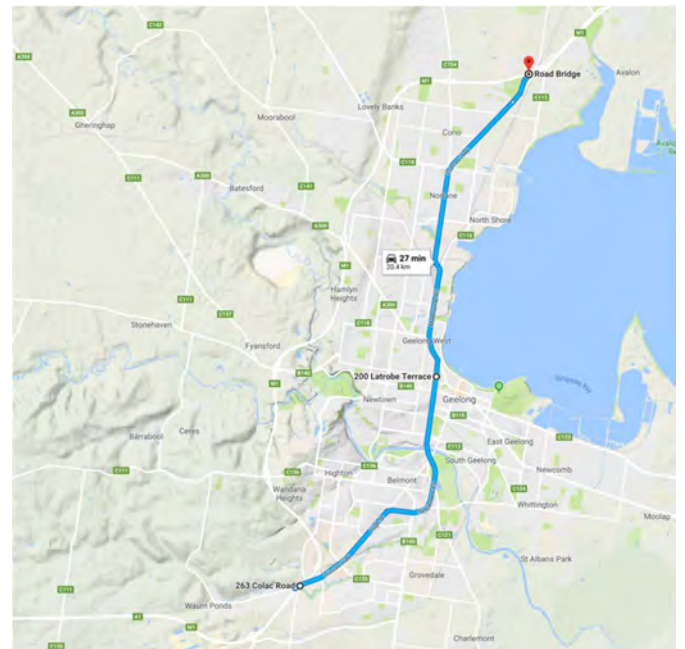


Figure 164 The Corio-Waurn Ponds Road between Waurn Ponds and Corio (Google Maps)

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

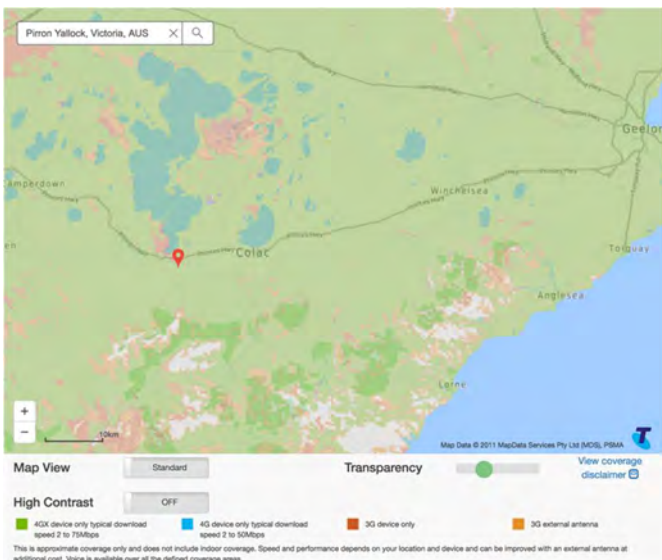


Figure 161 Telstra mobile coverage on the section of the Princes Highway West

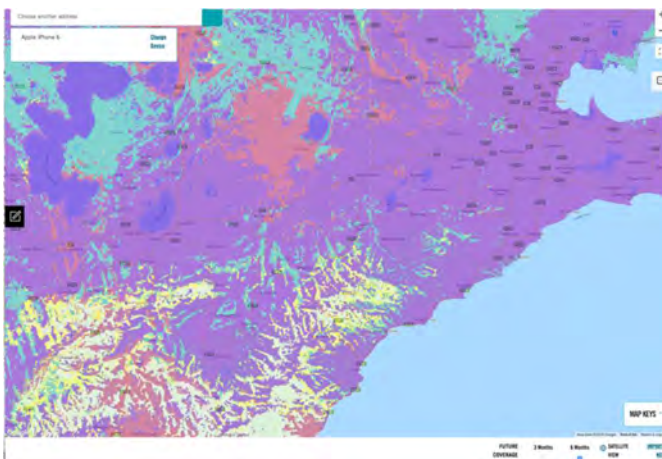


Figure 162 Optus mobile coverage on the section of the Princes Highway West

A300 Midland Highway (~4 km)

- From Geelong
- To Batesford

This highway connects Geelong with Ballarat, however only a 4 kilometre stretch falls within the regional Greater Geelong LGA area. The section of the highway within the region is illustrated below.

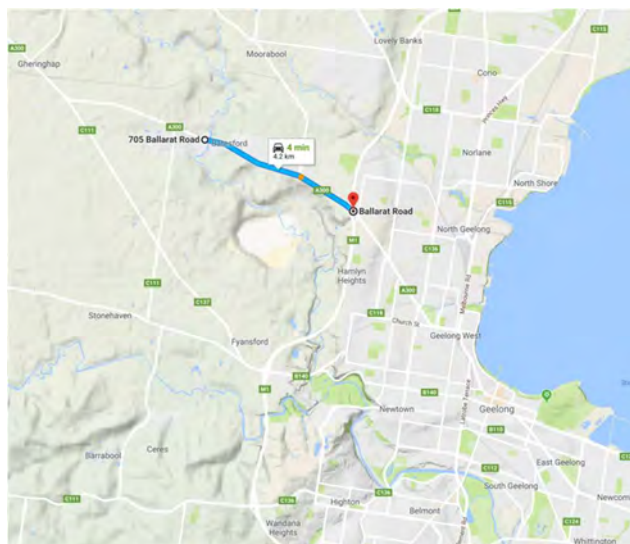


Figure 165 A300 Midland Highway (Google Maps)

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

B100 Great Ocean Road (~157 km)

- From Torquay
- To Yuulong (Gellibrand River)

This coastal tourist highway connects Torquay to the Princes Highway near Allansford. The section of the highway within the region is illustrated below.

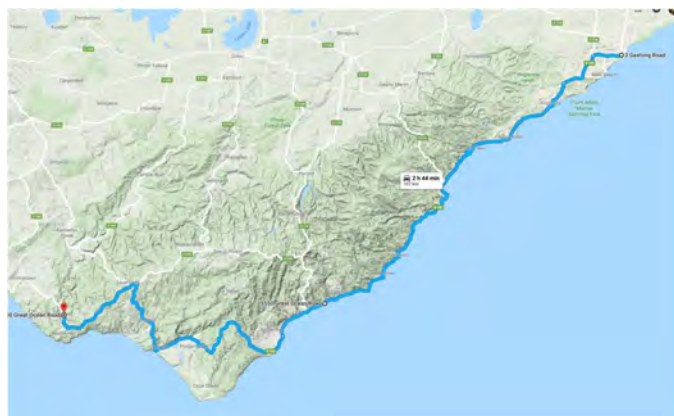


Figure 166 Section of Great Ocean Road between Torquay and Yuulong (Google Maps)

For the Mobile Black Spots Program, the State has prioritised improvements in emergency services coverage in high fire danger areas. Consequently, the challenges presented by this area are well understood and include:

- Extremely rugged coastal terrain with very little available land that is not classified as national park. This significantly increases the time and cost of construction.
- Due to the terrain, coverage provided by each base station tends to be very localised.
- Backhaul is particularly problematic, with high reliance on point-to-point microwave.

Based on public coverage maps:

- Telstra provides particularly poor coverage between Lorne and Yuulong as well as the coastal section around Separation Creek but otherwise shows relatively consistent 4GX outdoor coverage
- Optus similarly shows particularly poor coverage from Lorne, however Optus is constructing new coverage around Kennet River and near Beech Forest that will improve coverage via the Cape Otway National Park
- Vodafone shows no coverage between Apollo Bay and Yuulong via the Cape Otway National Park as well significant black spots between Kennett River and Lorne, but otherwise shows 4G outdoor coverage across the route.

In summary, there appears to be unreliable mobile coverage for all three mobile network operators across significant sections of the route.

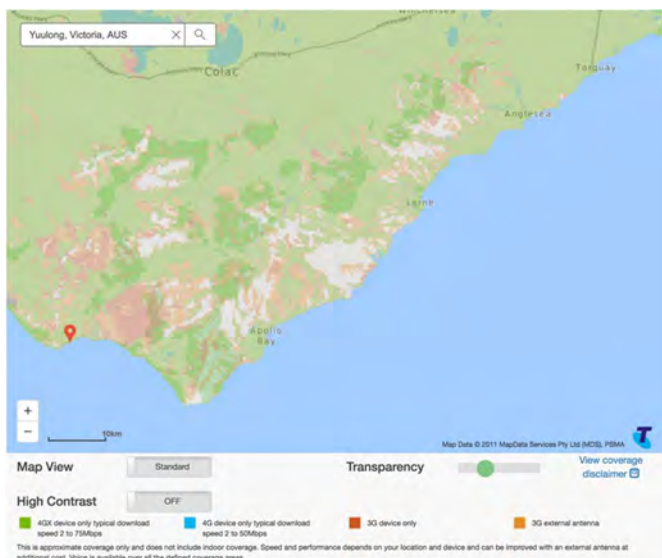


Figure 167 Telstra mobile coverage between Torquay and the western edge of the Colac Otway LGA

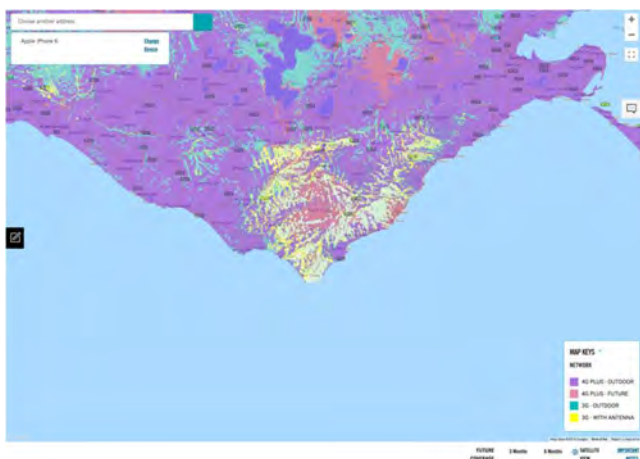


Figure 168 Optus mobile coverage between Torquay and the western edge of the Colac Otway LGA

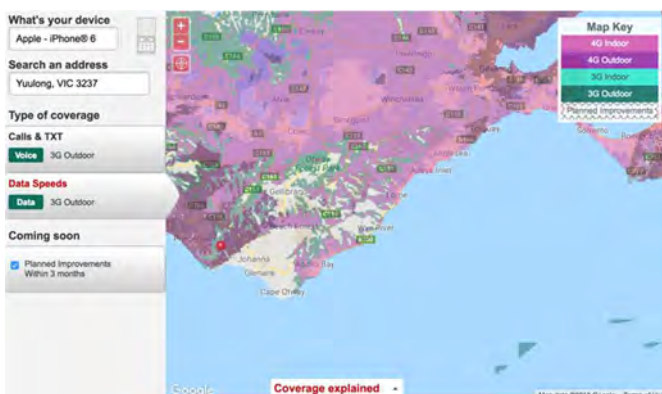


Figure 169 Vodafone mobile coverage between Torquay and the western edge of the Colac Otway LGA

B100 Surfcoast Highway (~18 km)

- From South Geelong
- To Torquay

This highway connects Geelong to Torquay and the start of the Great Ocean Road tourist highway.

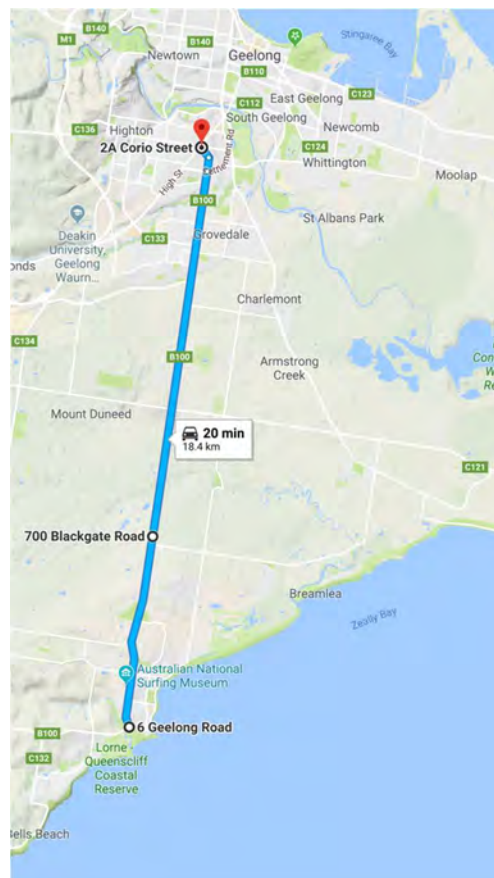


Figure 170 B100 Surfcoast Highway (Google Maps)

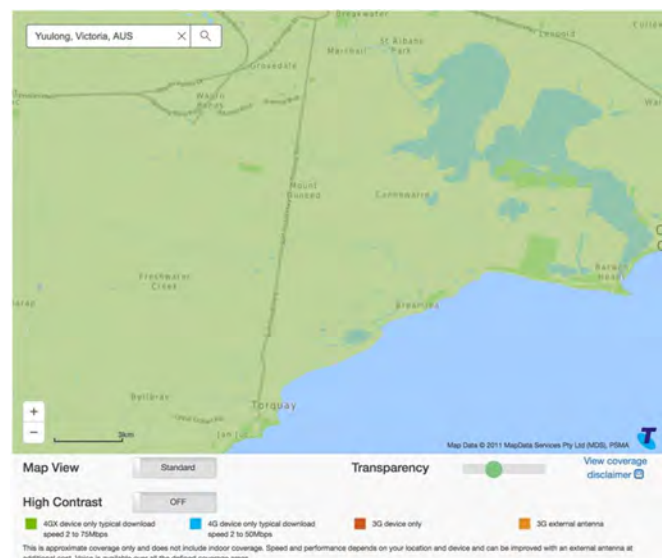


Figure 171 Telstra mobile coverage between South Geelong and Torquay

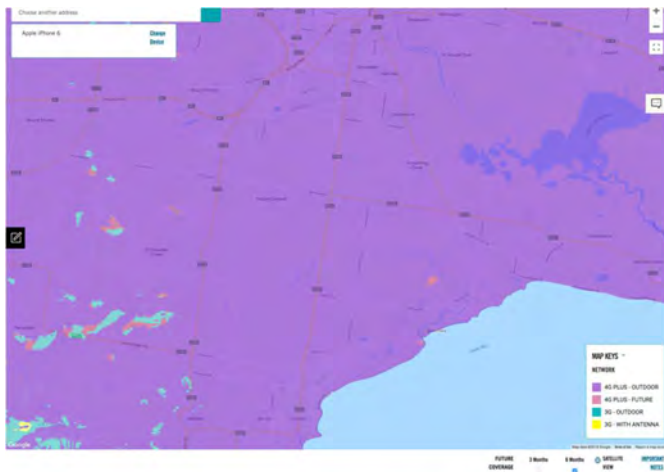


Figure 172 Optus mobile coverage between South Geelong and Torquay

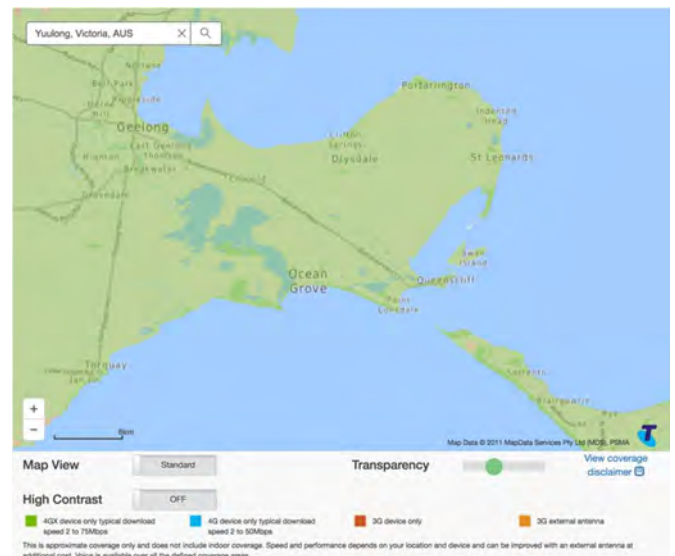


Figure 175 Telstra mobile coverage between South Geelong and Queenscliff

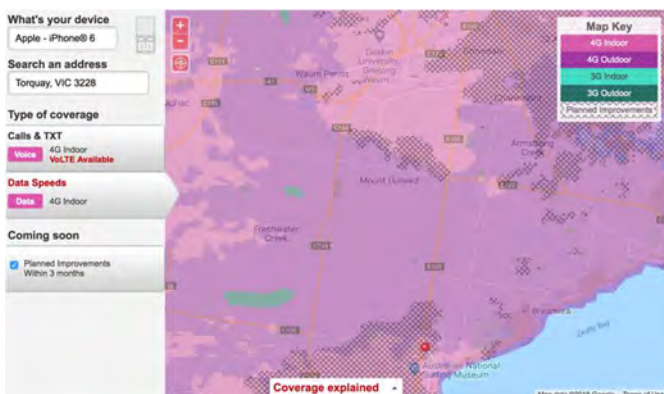


Figure 173 Vodafone mobile coverage between South Geelong and Torquay

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

B110 Bellarine Highway (~30 km)

- From South Geelong
- To Queenscliff

The highway is illustrated below.

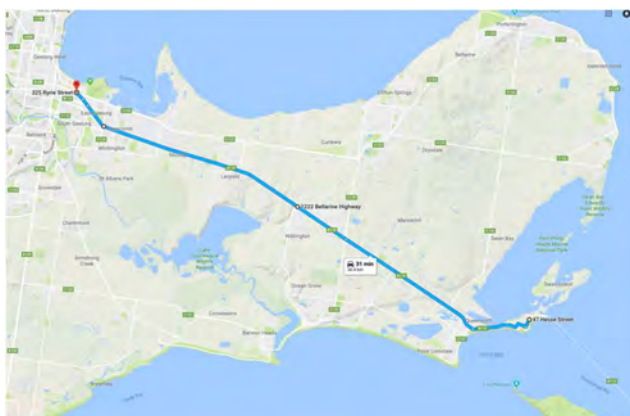


Figure 174 B110 Bellarine Highway (Google Maps)

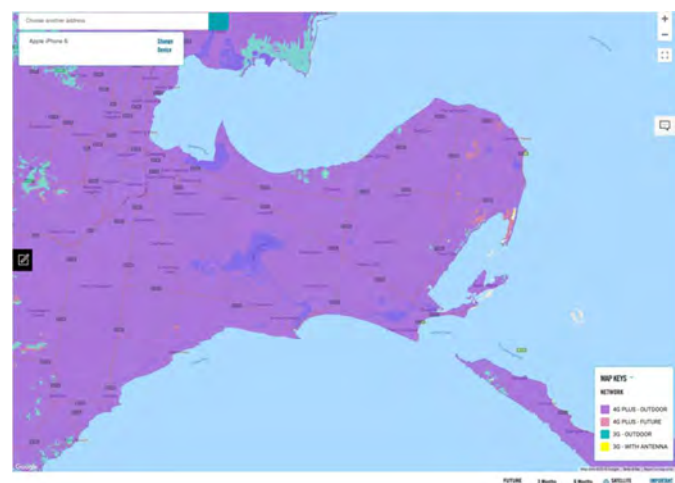


Figure 176 Optus mobile coverage between South Geelong and Queenscliff

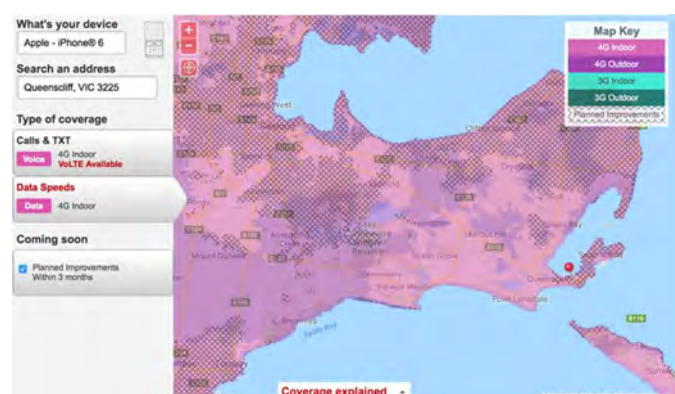


Figure 177 Vodafone mobile coverage between South Geelong and Queenscliff

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

6.4 C-Grade Roads

There are 43 declared C roads in the region forming a mesh between major and small communities. In general, there is good highway coverage across the majority of the region, however the areas of mountainous national park land and coastal terrain and consequently low population density presents challenges for all MNOs and unreliable service for 000 emergency calls.

6.5 Rail

Melbourne – Geelong

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

Geelong – Warrnambool

For passengers travelling onwards towards Warrnambool, the route carries up to eight services per weekday between Melbourne and Warrnambool. Annual patronage for 2017-18 was 176,000 - a 11.3% increase on 2016-17.

The route is served by V/Line diesel-hauled rolling stock and therefore there are no repeaters in the trains used to service this route. 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 Princes Highway West, trackside coverage for Telstra and Vodafone is predictably 4G continuous with 4G and 3G coverage for Optus.

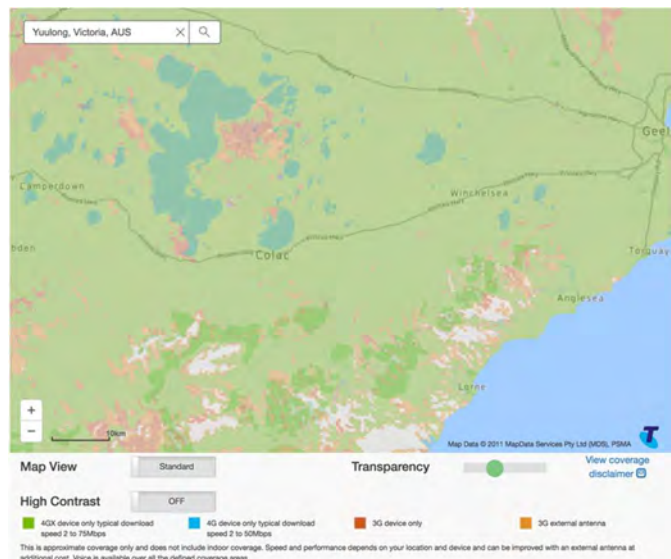


Figure 178 Telstra mobile rail coverage between Geelong and Camperdown

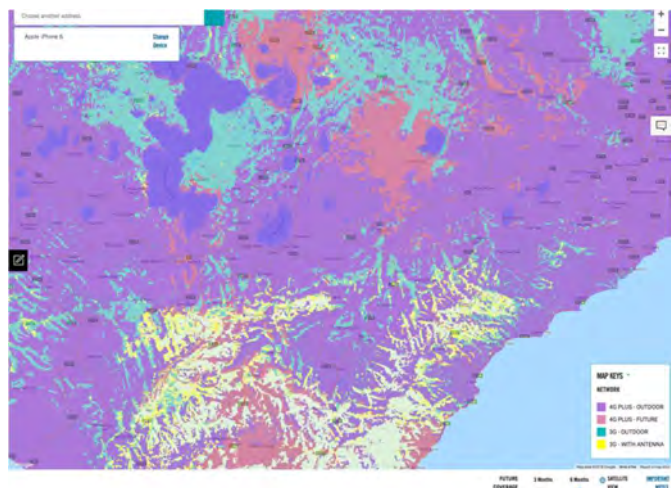


Figure 179 Optus mobile rail coverage between Geelong and Camperdown

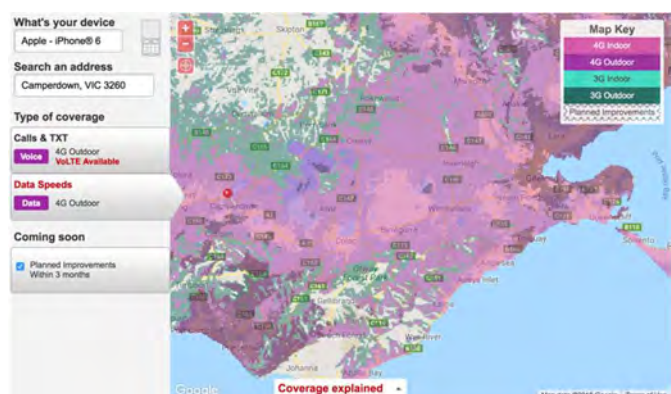


Figure 180 Vodafone mobile rail coverage between Geelong and Camperdown

In summary, there appear to be no mobile coverage issues on the route, with the three major mobile network operators all offering 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 and Qualifications

Acknowledgements

This report includes numerous images and cites many details about locations that have been obtained from a range of sources. Citing a reference for commonly accessed data sources would clutter the document and undermine the flow of relevant information.

Accordingly, this section sets out some important acknowledgements regarding data sources.

1. The **Australian Bureau of Statistics (ABS)** provides a rich repository of information at varying levels of aggregation. Two sources in particular have been used extensively over the period from May 2018 to October 2018 during which this report was prepared.

- Data by Region²⁸ – providing statistics at the level of Local Government Area (LGA).
- Quickstats²⁹ – providing statistics at varying levels of aggregation, but in particular, at the level of urban centre/locality (UCL) and slightly higher levels of aggregation as appropriate.
- These data are primarily drawn from the June 2016 Population Census.

2. Screen images generated by the **State Level Information Management (SLIM) Graphical Information System (GIS)** are compiled from various sources, and typically include an acknowledgement of the relevant sources in the bottom right corner of the image. Such acknowledgements have often been clipped from the images presented in this report, but are acknowledged (based on the type of background) as follows:

- For grey street map backgrounds: “Leaflet | © OpenStreetMap”
- For coloured street map backgrounds: “Leaflet | Tiles © Esri – Source: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012”

- For satellite imagery backgrounds: “Leaflet | Tiles © Esri – Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community”
- For plain grey background: “Leaflet | Tiles © Esri – Esri, DeLorme, NAVTEQ”
- For topographic backgrounds, “Leaflet | Tiles © Esri – Source: Esri, De Lorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, Geobase, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community”

3. For any screen capture of **Telstra’s** public coverage map that does not show an acknowledgement of the data sources, the following acknowledgement applies: “Map Data © 2011 MapData Services Pty Ltd (MDS), PSMA”.
4. For any screen capture of **Optus’s** public coverage that does not show an acknowledgement of the data sources, the following acknowledgement applies: “Map data ©2018 Google”.
5. For any screen capture of **Vodafone’s** public coverage that does not show an acknowledgement of the data sources, the following acknowledgement applies: “Map data ©2018 GBRMPA, Google”.
6. For any screen capture of **Sigfox** coverage that does not show an acknowledgement of the data source, the following acknowledgement applies: “Leaflet”.
7. Region-level Digital Inclusion Index data has been purchased from Roy Morgan.

Qualifications

1. The ABS periodically makes corrections to its data (including the 2016 Census data utilised widely in this report), so minor discrepancies may be noted between figures cited in this report and data obtained from the ABS website.

²⁸ See <http://stat.abs.gov.au/itt/r.jsp?databyregion>

²⁹ See for example http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/UCL211002?opendocument

2. Coverage by different network technologies reflects the situation at a point in time. Network operators regularly expand and reconfigure the networks with resulting changes to coverage. Before placing reliance on any information presented in this report, it is prudent to obtain the latest available information.
 3. Mobile reception depends on many factors including the type of device, whether the device has an external antenna and the like. Both the Optus and Vodafone public coverage maps require nominating a device. For consistency, the coverage maps shown are based on a “middle of the range” iPhone6.
 4. A fourth Mobile Network Operator (MNO) – TPG – is in the process of entering the Australian market. Its coverage intentions are not currently known.
-

B. Analytical Framework

The digital planning framework has been developed to systematically analyse the significant body of supply, demand and other key information gathered to support the digital planning process, which in turn provides the evidence base to recommend priorities on a place and sector-based level. This approach takes into account the significant diversity within the region. Analysis is conducted to provide a view of the current supply and demand situation and a three to five-year forward view. The framework is designed to be flexible, repeatable, easy to use and at the summary level at a glance and guide where to focus action to address the digital divide. Further development of this framework is required in subsequent digital plans.

The planning framework takes inputs from multiple information sources including:

- General regional characteristics
- Supply characteristics at a regional level
- Place-based analysis of population centres, the rural hinterland and key primary production areas, tourist locations and transport corridors
- SLIM database
- The Regional Digital Plans: Common Themes report
- Regional Assembly feedback
- Local government area surveys and onsite fieldwork
- The Digital Inclusion Index
- Australian Bureau of Statistics information
- Other sources highlighted in this document.

Shortfalls in internet access are identified by comparing supply and demand for public network access services classified by technology type (fixed, mobile, Internet of Things and WiFi) in different locations and for the various user groups (businesses, households, communities, visitors and road and rail travellers). This is done by assigning High, Medium and Low (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 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 in this first Barwon Digital Plan relates to the high-level city-country digital divide and simply acknowledges and discusses the locally-based digital divide issue.

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

The DII also shows substantial variation between and within regions, shown in the following chart.

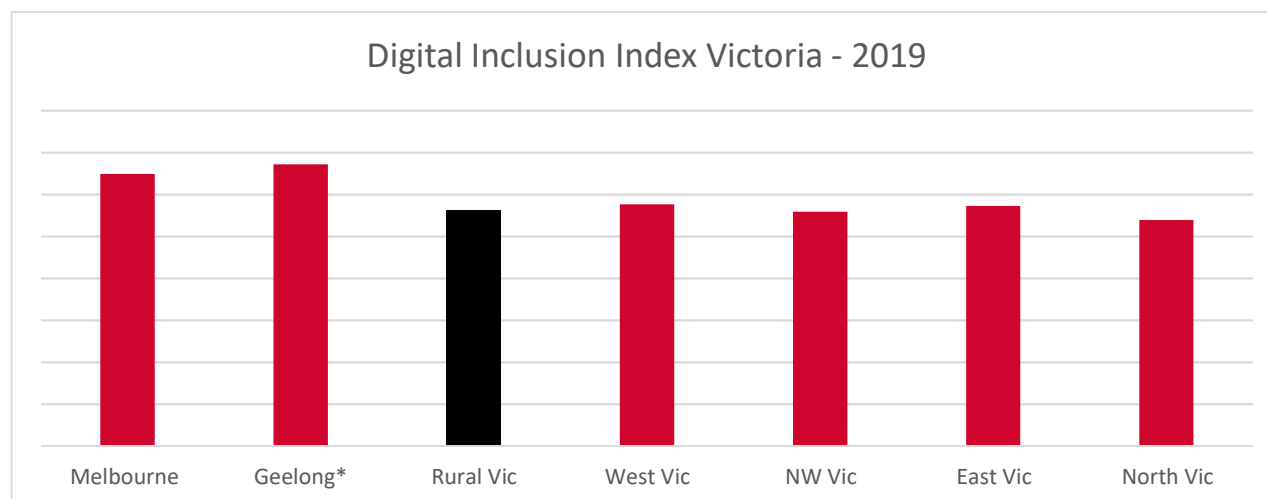


Figure 181 Summary of 2019 RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) findings across Victorian regions

*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).³⁰

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), 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.

³⁰ 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.

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 network (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 MNOs as the starting point for analysis – better data held by the MNOs 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 MNOs 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 MNOs 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 of 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 or 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.³¹ Free public WiFi is typically provided by local governments for disadvantaged citizens, the wider public and visitors in larger cities and towns.³² 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-priced mobile service will be lower value-for-money for regional users that frequently experience blackspots and degraded service.³³

In addition, unconfirmed anecdotal evidence indicates regional users are not offered the same range of specials and one-off customer retention incentives as their capital city counterparts. Anecdotal evidence also suggests the cost of bespoke connectivity solutions (such as a dedicated fibre connection) is higher in the regions as there are fewer competing suppliers.

Regarding ability to pay, it is well known that annual household incomes in the regions are on average substantially lower than in Melbourne: around \$50,000 compared to \$80,000. This means regional consumers in general, and these in lower-income regions and LGAs in particular, have a lower ability to pay than their capital city peers. Evidence on the ability to pay of regional businesses compared to this in capital city locations has not

³¹ 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

³² Free public WiFi is also provided by the operators of some cafes, fast food restaurants, shopping centers, airports, tourist locations and other commercial premises to improve customers’ on-site experience.

³³ The price of IoT services in the regions relative to capital city locations has not yet been conducted, but is expected to be higher on a quality-adjusted basis

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, MNOs – 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 recommendations outlined in the Digital Plan informed by this document address current and future unmet digital needs.

Options for addressing skills shortfalls are not developed in detail in this version of the Digital Plan due to the current 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.³⁴

Affordability solutions are not addressed in this first-generation Digital Plan. Data collection and analysis is the key immediate action to be undertaken.

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 Victorian 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.

³⁴ Involving the Department of Education and Training.



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