

Mackay Isaac Whitsunday region

Report

GW3

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Executive summary

Introduction

The Greater Whitsunday Alliance (GW3) has commissioned a digital infrastructure study for the Mackay Isaac Whitsunday (MIW) region. The aim of the study is to assess the current infrastructure gaps and identify future investment opportunities, with a focus on meeting future business needs.

The purpose of this study seeks to identify the gaps and investment opportunities in the region's digital infrastructure. Resultantly, this study aims to:

- Identify existing digital infrastructure assets and services in the region
- Snapshot the existing strategic planning for digital infrastructure across Commonwealth, State and local government
- Identify current global, national and local trends driving digital infrastructure
- Compile case studies to benchmark the MIW region from
- Identify the gaps and opportunities in digital infrastructure investment and planning
- Recommend priority action items.

What is digital infrastructure?

Digital infrastructure is described as the systems and services that store and exchange data. Digital infrastructure consists of both fixed and mobile infrastructure including mobile network, broadband services, fibre optics, satellites and data centres.

Stakeholder engagement

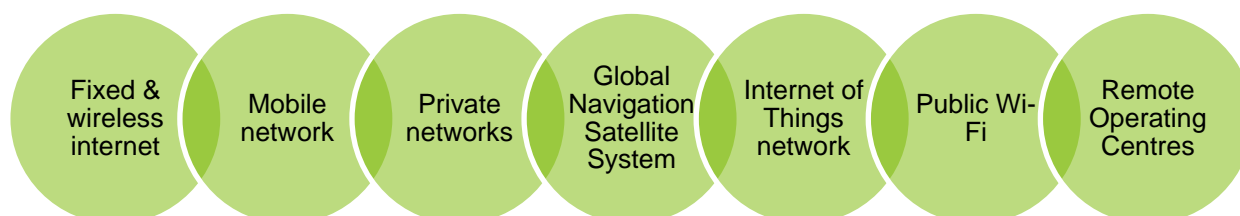
As part of this study information and opinion was sought from a range of stakeholders across key industries in the MIW region including telecommunications carriers, infrastructure providers and government agencies.

The MIW region

The Mackay Isaac Whitsunday region covers the local government areas (LGAs) of Mackay, Isaac and Whitsunday. The MIW region has the following key regional economic drivers: resources, mining equipment, technology and services (METS), agriculture and tourism.

Current digital infrastructure

An audit of the current digital infrastructure in the MIW region was undertaken on a technology type basis and a location basis. The digital infrastructure described in the figure and summarised below.



Fixed and wireless internet

The fibre optic network in the MIW region is largely serviced by the National Broadband Network (NBN) with other providers including Nexium, QCN Fibre (previously FibreCo), AARNet, Queensland Rail and Aurizon.

Internet access in rural and remote areas is via fixed wireless technology.

Mobile network

The mobile phone network is defined as a communication network where the last link is wireless and is based on a network of base stations. The MIW region is serviced by the three carriers:

- **Telstra** - 5 G is available in Mackay. 3G and 4G coverage is generally available in all urban areas. There are several areas where there is 3G coverage only that will require upgrades to 4G when the 3G network is obsolete, including Bloomsbury and Mount Coolon.
- **Optus** - 3G and 4G coverage is generally available in all urban areas. There are several areas where there is 3G coverage only that will require upgrades to 4G when the 3G is made redundant including Koumala. Optus have identified Hamilton Island and the outskirts of Moranbah as priority sites as well as the accommodation camps servicing the mining areas.
- **Vodafone** - 3G and 4G coverage is generally available only in the coastal urban areas.

The Mobile Black Spot Program (MBSP) is a co-investment program administered by the Commonwealth Government with the aim of improving mobile coverage in Australia. To date there has been 4 rounds of funding with 12 sites in the MIW region granted funds. Reported blackspots are concentrated around the road network

Private networks

Private Long-Term Evolution (LTE) networks are smaller in capacity and footprint than public LTE networks. The advantage of private LTE network is higher quality of service, and high reliability, availability and security. Private LTE networks are typically used by emergency services authorities, mining corporations, utilities and farmer's cooperatives.

Global Navigation Satellite System (GNSS)

Global Navigation Satellite System (GNSS) technology is utilised to determine position, velocity and time. Global Positioning System (GPS) is a widely used navigation network and is one of many GNSS. Fixed, ground-based reference stations which corrects errors of the original GPS signal are required for accurate applications in mining and agriculture.

Internet of Things (IoT)

The Internet of Things (IoT) refers to the connection of all kinds of devices to the internet and to each other. It spans not only the wide range of smart, connected products and services now available, but also the collection of data from these devices that can be used to improve business performance.

IoT technology can connect via the mobile network, a Low Power Wide Area Network (LPWAN), satellite and Bluetooth. Mackay Regional Council has a LPWAN network to service their smart water meter infrastructure.

Public Wi-Fi hotspots

A public Wi-Fi hotspot is a physical location where people may obtain internet access, using Wi-Fi technology. Public Wi-Fi hotspots provide users an alternative internet connection to mobile phone networks and give people with an internet-enabled portable device without a mobile SIM an opportunity to access the internet. All three Councils with the MIW region offer some public Wi-Fi services.

Strategic digital infrastructure planning

Strategic digital infrastructure planning is undertaken at all levels of government:

■ Commonwealth

The Commonwealth government is the key legislative administrator for the communications industries through the Department of Infrastructure, Transport, Regional Development and Communications, and the Australian Communications and Media Authority. The Commonwealth government has several digital infrastructure initiatives including the Mobile Black Spot Program, the Positioning Australia program and the Smart Cities initiative.

■ State

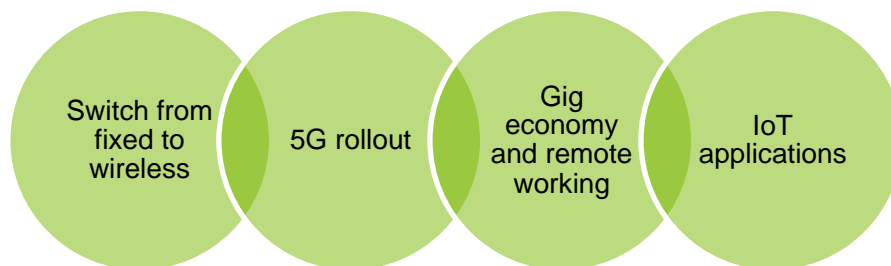
The Queensland state government has undertaken digital infrastructure planning at the State-level and is a co-contributor. Queensland Rail and several Queensland government owned business - Energy Queensland and Powerlink - have fibre optic networks.

■ Local

Local government roles in telecommunications planning are primarily as a planning regulator for new development and infrastructure and as an asset owner of digital infrastructure including LPWAN networks and fibre optic networks.

Digital infrastructure trends

The four main trends impacting on digital infrastructure in Australia are:



Switch from fixed to wireless

The advancement in smart phones and an increasing number of business applications being optimised for mobile devices along with the decreasing price of mobile data has prompted a switch from businesses relying on fixed line access to wireless.

The Internet Activity Report produced by the ACCC reported that 51 per cent of internet access connections in Australia were via mobile wireless. The Wireless Telecommunications Carriers in Australia report published by IBIS World in January 2019 reported mobile data usage is anticipated to continue replacing traditional voice calls, SMS and MMS as smartphone apps that improve on these features and video streaming and social networking.

5G

5G is the next generation of the mobile network technologies. 5G provides higher data rates, ultra-low latency, increased bandwidth and more connections than 4G technology. The rollout of 5G technology has started in Australia.

Gig economy and remote working

The gig economy is a labour market characterised by short-term contracts or freelance work as opposed to permanent jobs. Part-time employment has increased with flexible and remote work a growing trend. Digital infrastructure is required to give employees and employers more options in their working environment.

IoT applications

IoT solutions are well positioned to drive a step change in productivity in the agriculture, manufacturing and mining sectors. Industries require remote monitoring, such as livestock health and environmental sensors, and stable and controlled repetitive tasks are ideally placed to adopt IoT applications.

In the MIW region the reef protection regulations impacting the sugar cane, grazing and horticulture industries and the move to Industry 4.0 will impact on the adoption of digital technology and demand for digital infrastructure.

Examples of IoT implementations that could be or already are being applied:

Agriculture	<ul style="list-style-type: none"> ■ Livestock health and location monitoring ■ Autonomous farm vehicles ■ Environmental sensor for water, soil and weather conditions ■ Automatic irrigation and feed stations
Construction	<ul style="list-style-type: none"> ■ Autonomous construction equipment ■ Robots for repetitive tasks ■ Possible integration with Building Information Modelling (BIM) systems
Healthcare	<ul style="list-style-type: none"> ■ Sensors providing real-time inventory and monitoring of patient vitals ■ Patient movement tracking
Manufacturing	<ul style="list-style-type: none"> ■ Autonomous vehicles ■ Autonomously recognising humans in the vicinity of operational equipment for safety.
Mining	<ul style="list-style-type: none"> ■ Sensors provide real-time productivity monitoring of machinery. ■ Autonomous machinery will improve precision and site productivity

Digital infrastructure gaps and opportunities

To assess the gaps and opportunities, the results of the audit of the current digital infrastructure in the MIW region was compared to the current government initiatives, the regional benchmarks and the digital infrastructure trends. This is summarised in the table below:

	Gap	Opportunity
Fibre	Redundancy in the fibre optic networks underutilised by the energy and rail companies.	Potential opportunity for the Councils to investigate capitalising and expanding Council-owned fibre optic network.
Fixed wireless	Fixed wireless technology reliance for rural based business.	Option for customers to pay to upgrade their connection technology through NCN Co's Technology Choice program.
Mobile network	The MIW region has gaps in the mobile network in terms of blackspots and 4G coverage.	Continued support of MBSP funding Support for blackspot and further expansion of 4G and 5G rollout through: <ul style="list-style-type: none"> ■ Access to public assets, planning incentives ■ Spot fixes ■ Shared infrastructure There is an opportunity for the MIW region to push for the 5G rollout to be accelerated across region.
Global Navigation Satellite System (GNSS)	GPS accuracy is unreliable for farms in more remote or obstructed areas due to the low density and coverage range of RTK base stations.	There is an opportunity for further trial implementation studies to determine the viability of expanding/densifying the Mackay Sugar GPS base station network, versus exploring other GPS correction technologies such as SBAS.
Internet of Things (IoT) LPWAN network	There is currently no open LPWAN in the MIW region.	There is an opportunity to establish an open, public LPWAN network and commercial LPWAN network on the back of Council owned/operated network in the urban areas.
Public Wi-Fi hotspots	There are patches of public Wi-Fi offered in the MIW region.	There is an opportunity to introduce public Wi-Fi at strategic tourist locations and for the expansion of eduRoam Wi-Fi network. eduRoam is a secure global roaming wireless network for the research and education sector. eduRoam in Australia is operated by AARNet.

5G ready

There is an opportunity for the MIW region to push for the 5G rollout to be accelerated in the region. Telstra rolled out a limited 5G coverage in Mackay in February 2020. A business case for 5G uses would need to be analysed. Townsville, Rockhampton, Bundaberg and Cairns have recently had 5G base stations made active for public use. According to Telstra, this is primarily due to a large customer base in these cities. There is potential opportunity for the METS sector businesses in Paget to build a case for 5G coverage supporting innovation.

Mapping public assets and infrastructure

There is an opportunity for the region to create a database of suitable assets and infrastructure, such as underground ducts, dark fibre networks, buildings and other structures, CCTV networks, streetlights and other street furniture, to encourage investment in blackspot areas.

Shared infrastructure

With the emergence of the 5G network, there is considerable discussion around the advantages of shared infrastructure to establish the optimum design of the 5G roll-out. Several ways in which mobile network infrastructure can be shared are:

- Sharing of towers or masts, and possibly power supply equipment, but with each operator providing its own base station electronics, backhaul and antennas;
- Sharing of the entire radio access network (RAN), including the site, mast, antenna, base transceiver station (BTS or gNodeB in 5G parlance), backhaul and base station controllers;
- Sharing of the RAN and the spectrum held by each operator;
- National roaming — when a mobile customer uses a network not provided by their operator.

The Axicom portfolio consists of approximately 1,900 tower and rooftop sites across Australia, most of which are leased from land/building owners. As an infrastructure supplier with no operating network presence, Axicom facilitates the maximum use of towers on a competitively neutral basis as between individual service providers. Axicom's aim is to make infrastructure available to co-users for the environmentally and economically efficient deployment of communication networks throughout Australia.

Public Wi-Fi

There is an opportunity to introduce public Wi-Fi at strategic tourist locations. Public Wi-Fi at Cape Hillsborough or Whitehaven Beach would increase tourists' opportunity for live uploads and sharing their experience instantly, therefore increasing exposure. Tourism stakeholders including Mackay Tourism have noted that international tourists are more likely to connect with public Wi-Fi as they do not need a device with a SIM card to connect to the mobile phone network. This is a key opportunity for the tourist industry in Mackay and Whitsunday regions.

There is an opportunity for the expansion of eduRoam Wi-Fi network. eduRoam is a secure global roaming wireless network for the research and education sector. eduRoam in Australia is operated by AARNet.

Remote Operating Centres (ROCs) and Remote Asset Management Centres (RAMCs)

Remote operation centres (ROCs) are reported to be one of the key initiatives for reducing operating and maintenance costs and increasing productivity by major resource companies in their efforts to remain globally competitive. Another consequence of ROCs is the development of Remote Asset Management Centres (RAMCs), to assist in managing skills shortages in remote areas.

Considerable discussions have been held by development agencies on whether a Mackay or Moranbah based remote operations centre would present benefits to Bowen Basin miners. There are some technology and infrastructure barriers to facilitate the creation of secure and effective digital systems for remote control operations. Major mining companies would need the same connectivity and modern digital infrastructure as the current BHP private Brisbane data connections for Mackay and Moranbah to be viable.

The Queensland Resources Council are considering research into a remote operations centre project to look at an industry approach to improving digital infrastructure, in a coordinated way.

Recommended regional priority areas

Action	Focus 0-18 months	Accelerate 18-36 months	Lead	Partner	Next steps	
Establish individual Council working groups						
1. Each Regional Council create a Working group to unlock digital opportunities in their LGA	Mackay, Isaac and Whitsunday Regional Councils each commit to forming a working group to facilitate discussions regarding the adoption of recommended priority action items 2-7, 9 and 10.	●		Mackay Regional Council Isaac Regional Council Whitsunday Regional Council		Establish working groups
Working groups assess the feasibility of extending the use of Council-owned digital infrastructures						
2. Public, open LoRaWAN network	Potentially offering a public, open, low-cost LoRaWAN network in conjunction with the delivery of other Council services	●		Regional Council working groups	The Things Networks	Assess the technical feasibility Council decision
3. Commercial LoRaWAN network	Potentially establishing a commercial IoT network piggybacked off the public LoRaWAN network		●	Regional Council working groups		Cost-benefit analysis Council decision
4. Council as a fibre network provider	Potentially establishing of Council-owned commercial fibre optic network piggybacked off existing fibre infrastructure		●	Regional Council working groups		Cost-benefit analysis Council decision
Facilitating the improvement of the mobile network						
5. Coordinated blackspot funding approach	Develop a regional approach to Mobile Blackspot Funding by: <ul style="list-style-type: none"> ■ Developing a list of priority blackspot sites with a focus on roads, tourist attractions and workers accommodation villages 	●		GW3	Regional Council working groups Mobile carriers	GW3 to review current blackspots and liaise with Council on prioritisation

Action		Focus 0-18 months	Accelerate 18-36 months	Lead	Partner	Next steps
	<ul style="list-style-type: none"> Mapping Council and other public assets suitable for hosting mobile base stations or small cells Engaging with independent mobile infrastructure providers to provide blackspot solutions 				Independent mobile infrastructure providers Queensland Department of Public Works and Housing Commonwealth Department of Infrastructure, Transport, Regional Development and Communications	
6. Accelerated 5G rollout	Advocate to the carriers for an accelerated 5G rollout in the MIW region	●		Regional Council working groups GW3	METS industry Mobile carriers	GW3 to lead advocacy efforts
7. Spot fixes	Develop a list of areas of poor coverage suitable for low-cost spot fixes funded by Council	●		Regional Council working groups GW3	Mobile carriers	GW3 to lead liaison with Councils
8. Fixed wireless technology upgrades	Develop a list of potential locations suitable for fixed wireless technology upgrades through the NBN Technology Choice program		●	GW3	NBN Co	GW3 to lead liaison with NBN Co
9. Planning incentives	Review current planning policies for opportunities to encourage mobile network infrastructure in new development including mobile base stations and small cells		●	Regional Council working groups	Queensland Department of State Development, Manufacturing, Infrastructure and Planning	GW3 to advocate for consistency in approach across Councils

Action		Focus 0-18 months	Accelerate 18-36 months	Lead	Partner	Next steps
Establishing place specific infrastructure						
10. Expansion of public Wi-Fi	Investigate the expansion of the eduRoam Wi-Fi network to the Mackay and Whitsunday council public Wi-Fi networks	●		Regional Council working groups AARNET	CQUni	GW3 to inform the process
	Identify value-adding opportunities for public Wi-Fi in tourist locations	●		GW3	Queensland Department of Environment and Science Mackay Tourism Tourism Whitsundays	GW3 to inform the process
11. Shared IoT network for agricultural use	Develop a program to accelerate the adoption of IoT technology through the establishment of a shared IoT network for agricultural use		●	GW3 Queensland Department of Agriculture and Fisheries	Mackay Sugar Canegrowers	GW3 to initiate discussion and progress opportunities
12. Expansion of the GPS base station network	Examine the feasibility of expanding the Mackay Sugar GPS base station network for broader precision agriculture, including exploring alternate GPS correction technologies and GIS mapping of ideal base station locations		●	GW3 Queensland Department of Agriculture and Fisheries	Mackay Sugar Canegrowers	GW3 to initiate discussion and progress opportunities

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Glossary

Term	Definition
Cable	Broadband connection using cable television (CATV) infrastructure. The connection uses a coaxial cable or Hybrid Fibre Coaxial (HFC).
Dark fibre	Unused optical fibre. Can be used to refer to potential network capacity.
Digital Subscriber Line (DSL)	The first generation of broadband utilising the telephone copper wire network. Also referred to as Asymmetric Digital Subscriber Line (ADSL, ADSL2, ADSL2+) and Symmetrical Digital Subscriber Line (SDSL).
Fibre	Optical fibre connection including Fibre to the Premises (FTTP), Fibre to the Node (FTTN), Fibre to the Home (FTTH), and Fibre to the Building (FTTB).
Fixed wireless	A terrestrial point-to-point microwave or radio link, generally building to building or tower to building.
Global Navigation Satellite System (GNSS)	Generic term to describe satellite navigation systems that provide automatic geospatial position of receivers with global coverage.
Global Positioning System (GPS)	Most widely used component of the GNSS, referring to the NAVSTAR satellite constellation developed by the US Department of Defence.
Internet of Things (IoT)	A system of interrelated computing devices/, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.
Latency	Delay in the transmitting or processing data
Long-Term Evolution (LTE)	A 4G wireless communications standard designed to provide increased capacity and speed compared to 3G. A foundation technology for true 4G, widely referred to as "3.95G".
Low Power Wide Area Network (LPWAN)	A wireless, wide area network the connects low-bandwidth devices over long ranges.
Mbps	Megabits per second
Mobile wireless	An internet connection which provides short range, high data rate connections between mobile data devices and access points connected to a network including 3G/4G accessed through a datacard, USB modem or tablet SIM card.
Real-Time Kinematics (RTK)	A differential GNSS technique to provide high-accuracy positioning (~10 cm) within the close (~30 km) vicinity of a base station that transmits corrections to the receiver.
Satellite	Internet access provided through a satellite.
Satellite-Based Augmentation System (SBAS)	Combined used of space-based and ground-based infrastructure the improve accuracy of GNSS signals. Can provide sub-metre accuracy.
Wi-Fi Wireless fidelity	A family of wireless networking technologies, based on the IEEE 802.11 family of standards, which are commonly used for local area networking of devices and Internet access

1 Introduction

1.1 Background

The Greater Whitsunday Alliance (GW3) has commissioned Aurecon to complete a digital infrastructure study for Mackay Isaac Whitsunday (MIW) region. The aim of the study is to assess the current infrastructure gaps and identify future investment opportunities with a focus on meeting future business needs.

In 2015, the Whitsunday Regional Organisation of Councils (ROC) (the previous Greater Whitsunday Council of Mayors) published the *Digital Economy Strategy and Action Plan* (February 2015). The purpose of the strategy and action plan was to identify actions necessary to enhance the digital capability of industry, businesses and communities in the MIW as well as the digital capabilities of local government services.

1.2 Purpose

The Greater Whitsunday Alliance is an economic development group sponsored by Mackay, Isaac and Whitsunday Regional Council as part of the Greater Whitsunday Council of Mayors.

The purpose of this study is to identifying gaps and highlight investment opportunities in the region's digital infrastructure. The study aims to:

- Identify existing digital infrastructure assets and services in the region
- Snapshot the existing strategic planning for digital infrastructure across Commonwealth, State and local government
- Identify current global, national and local trends driving digital infrastructure
- Compile case studies to benchmark the MIW region against other regional centres in Queensland
- Identify the gaps and opportunities in digital infrastructure investment and planning
- Recommend priority action items

1.3 What is digital infrastructure?

Digital infrastructure defines the systems and services that store and exchange data. Digital infrastructure consists of both fixed and mobile infrastructure including mobile network, broadband services, fibre optics, satellites and data centres. A visual representation is outlined in the figure below.

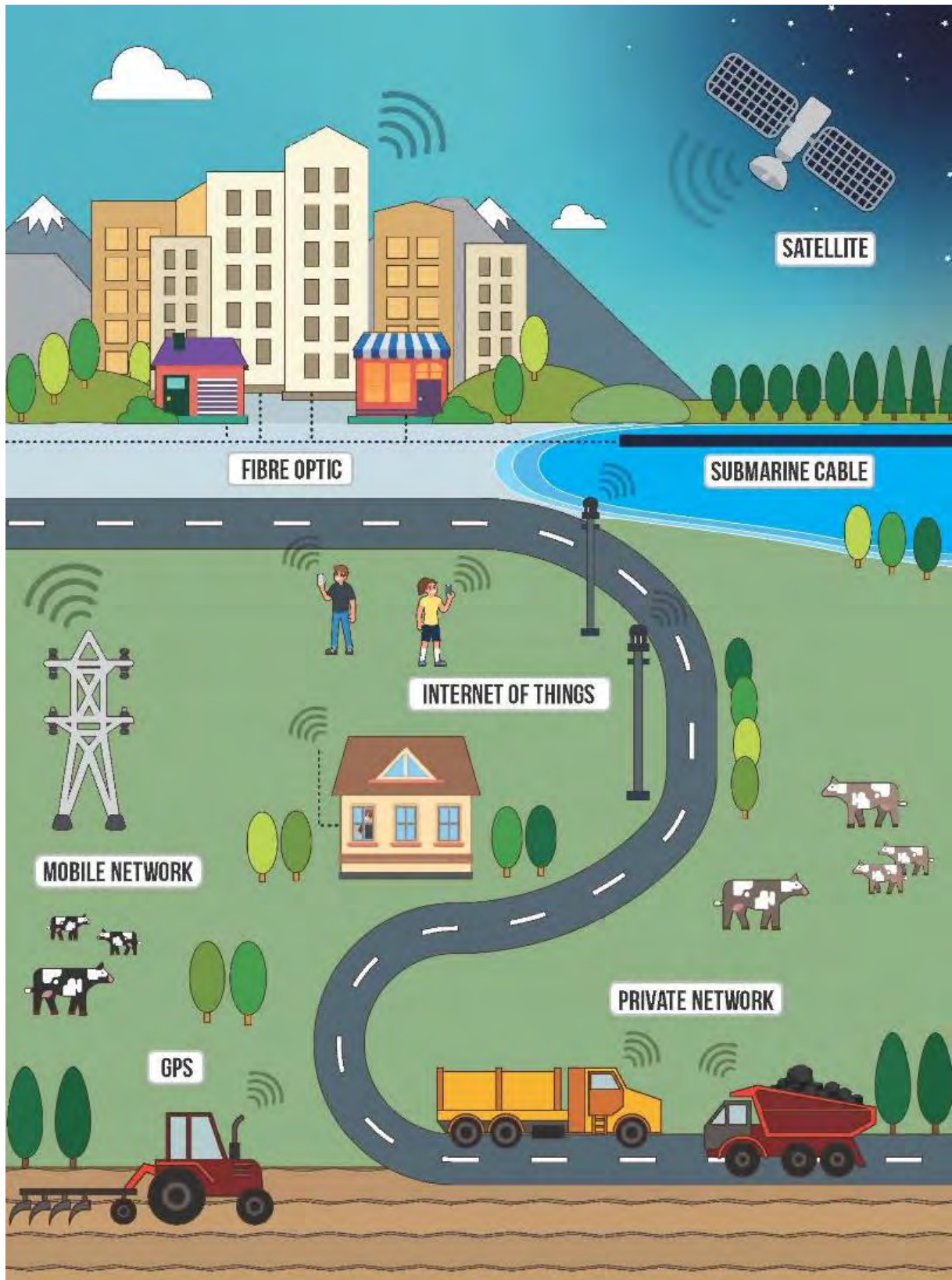


Figure 1 Visual representation of digital infrastructure

Access to digital infrastructure is needed for people to fully participate in both today's society, and the continually changing and evolving economy of the 21st century. As recently quoted:

Participation in the digital world is no longer a luxury, it is an integral part of everyday life.

2018 Regional Telecommunications Review p6

Reliable digital infrastructure is critical for regional areas to connect to banking, healthcare, entertainment and government services. Emerging technologies in agriculture and mining including, drones and vehicle automation need to be supported by adequate and efficient infrastructure.

1.4 Stakeholder engagement

An overview of the stakeholder's engaged through the delivery of this study are summarised below. This includes a Steering committee responsible for setting strategic objectives and local industry.

1.4.1 Steering committee

The steering committee participated in an inception meeting held on the 23 August 2019 and a workshop on 7 November 2019.

The steering committee members are:

- Adrienne Rourke, General Manager at Resource Industry Network
- Jeff Stewart Harris, Director Planning, Environment and Community Services at Isaac Regional Council
- Kylie Porter, Chief Executive Officer at GW3
- Nadine Connolly, Senior Economic Development Officer at Mackay Regional Council
- Peter Berardi, Principal Economic Development Officer at Department of State Development, Manufacturing, Infrastructure and Planning
- Shane Brandenburg, Manager Economy and Prosperity at Isaac Regional Council
- Teona Cousin, Manager Economic Development and Tourism at Mackay Regional Council

1.4.2 Regional stakeholders

A range of businesses and organisational stakeholders representing the following industries in the MIW region were approached:

- Agribusiness
- Education
- Mining and METS
- Retail
- Tourism

The stakeholders were asked to provide feedback on availability and reliability of the current digital infrastructure and future trends and demands.

A list of stakeholders who provided feedback to the study are listed in **Appendix A**.

1.4.3 Industry stakeholders

Feedback was sought from the service providers - Telstra, Optus, NBN Co and AARNET. Optus, NBN Co and AARNET each provided information of their current level of service and future plans for the MIW region.

Additionally, individuals with experience in the information technology (IT) and communications sector in the MIW region were approached to provide feedback on potential gaps and opportunities.

2 Mackay Isaac Whitsunday region profile

2.1 Location

The Mackay Isaac Whitsunday region covers the local government areas (LGAs) of Mackay, Isaac and Whitsunday. The MIW region covers 90,000 km² from St Lawrence in the south, to Bowen in the north and beyond Clermont in the west.



Source: Regional Economic Profile Mackay Isaac Whitsunday, November 2018 (GW3)

Figure 2 Map of the MIW region

2.2 Population profile

The population of the MIW region was 169,688 residents with a medium age of 37 at the 2016 census. Most of the population live in the Mackay LGA.

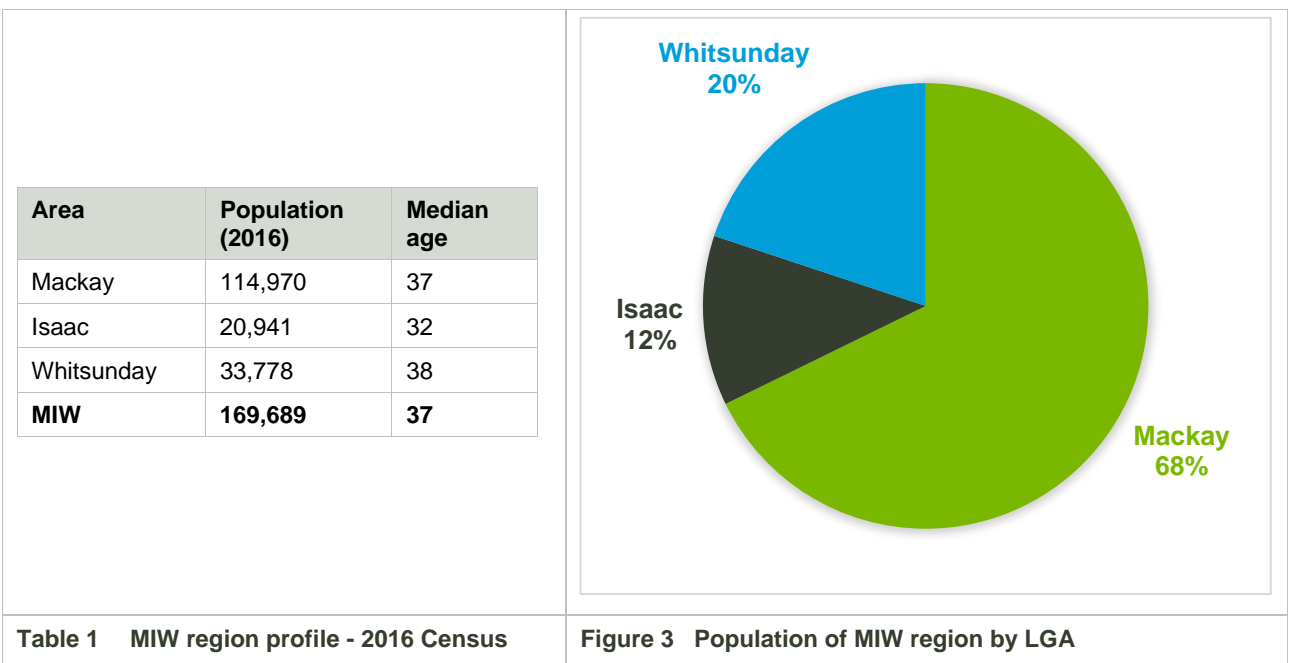


Table 1 MIW region profile - 2016 Census

Figure 3 Population of MIW region by LGA

2.3 Economic profile

The MIW region has the following key regional economic drivers:

- **Resources**

The MIW region is positioned with the Bowen and Galilee basins containing the largest coal mining deposits in Australia. The majority of Queensland’s prime coking coal is located in the MIW region with 26 operating mines.

- **Mining Equipment, Technology and Services (METS)**

The MIW region has an advanced METS sector creating products as solutions worldwide.

- **Agriculture**

The MIW region has a strong agricultural sector as one of the Australia’s largest sugar and bio commodity producers with 28 percent of Australia’s sugar cane, one of the largest winter produce horticulture growing regions in Australia and 5 per cent of Australia’s beef.

- **Tourism**

The MIW region is a competitive tourism destination based on natural attractions centred on the Whitsundays and the Great Barrier Reef, as well as emerging tourist attractions in the Mackay and Isaac regions.

The *Mackay Isaac Whitsunday Regional Economic Profile* released by GW3 in November 2019 reported the MIW region has an output (gross revenue) generated by businesses and organisation of \$39.648 billion. Figure 4 below illustrates the output for each industry by LGA. Across the MIW region, top three industries were:

- Mining: \$18,356 million (46.3 per cent of the total output for the MIW region)
- Manufacturing: \$3,587.82 (9 per cent)
- Construction: \$2,763.23 (7 per cent)

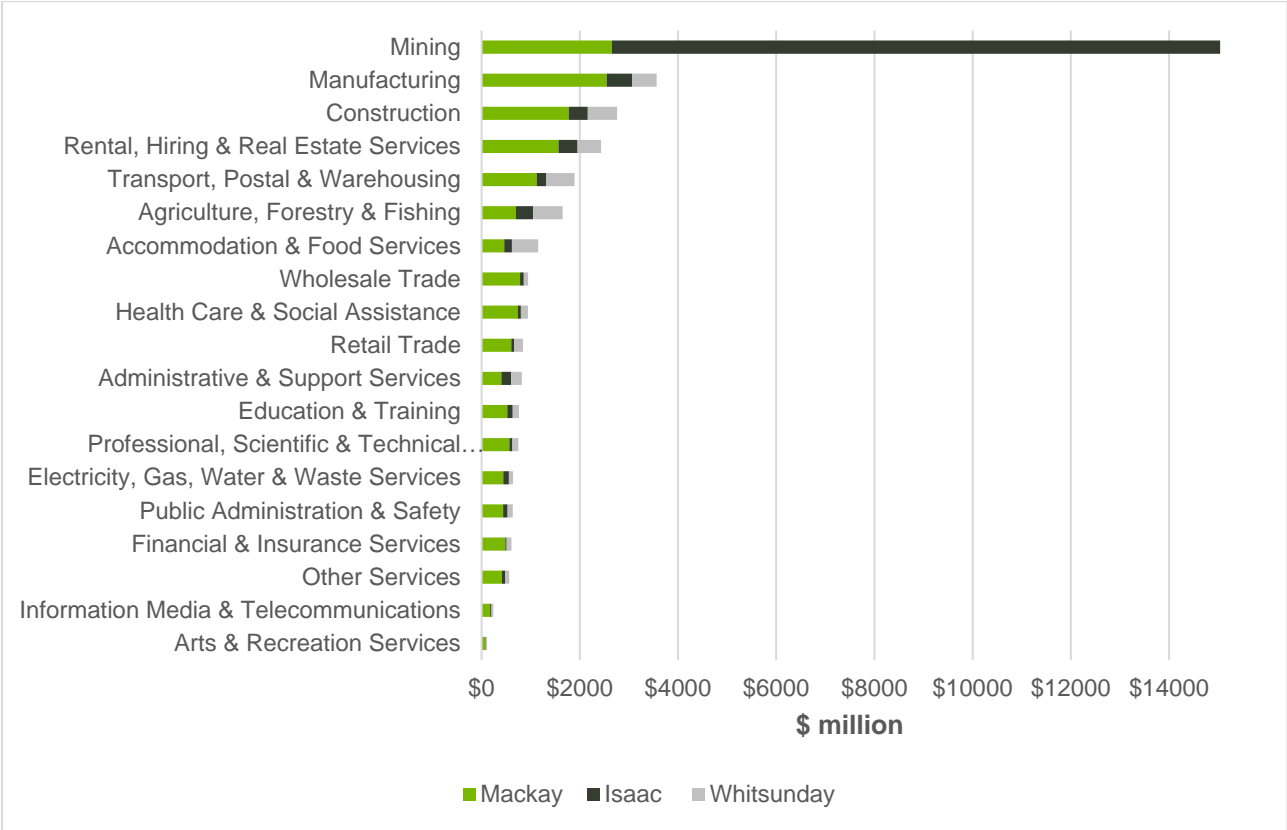


Figure 4 Output per industry per LGA (2019)

Based on the ABS 2019 release of the counts of Australian businesses, there are 15,062 business in the MIW region as of June 2018. The top industries represented are:

- Agriculture, forestry and fishing: 3,339 business (22 per cent of the total in the MIW region)
- Construction: 2,332 (15 per cent)
- Rental, hiring and real estate services: 1,686 (11 per cent).

Figure 5 below summaries the number of business per employee count. Most of business in the MIW region are small businesses:

- 60 per cent of all businesses counted in MIW region are non-employing / sole traders
- 38 per cent employ under 19 employees.

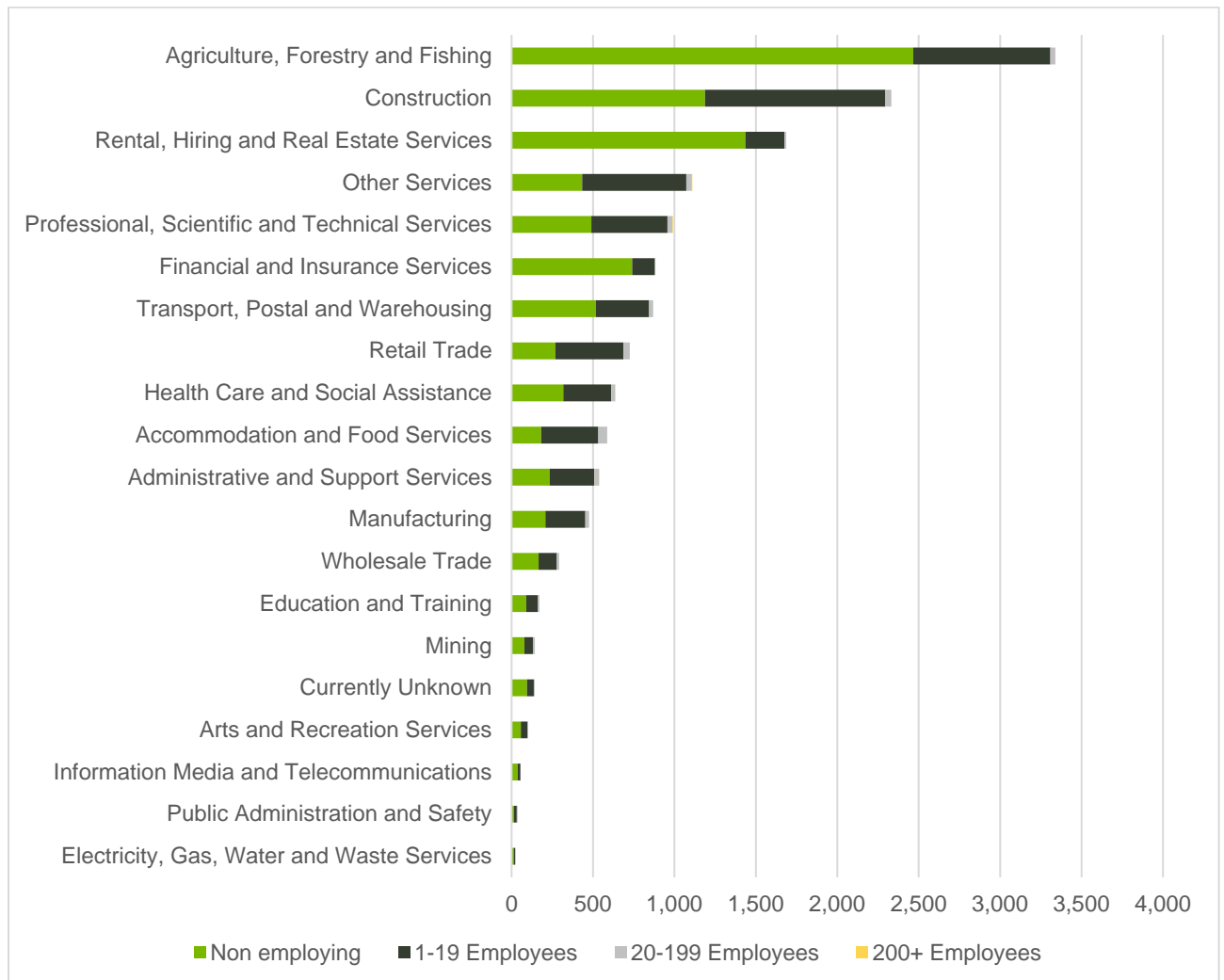


Figure 5 Business count per employee count per industry for the MIW region (as of June 2018)

Based on the 2016 census the top three employing industries for each LGA are summarised in the table below.

Table 2 Top employing industries across Mackay, Isaac and the Whitsundays (Source: Australian Census, 2016)

Mackay	Isaac	Whitsunday
1. Mining 12.4%	1. Mining 37.7%	1. Accommodation and food services 15.8%
2. Healthcare and social assistance 10.7%	2. Agriculture, forestry and fishing 10.4%	2. Retail trade 9.6%
3. Retail trade 10%	3. Education and training 6.6%	3. Agriculture, forestry and fishing 9.3%

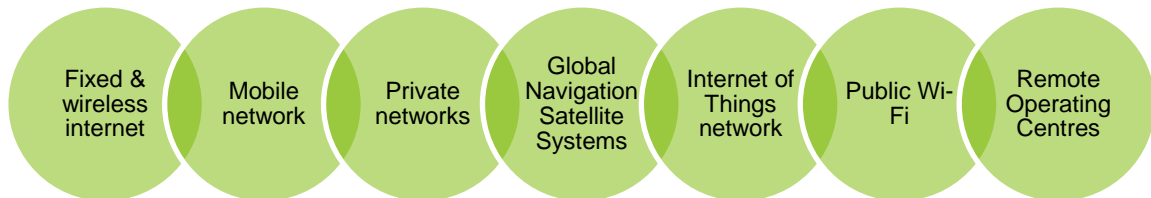
All three regions are reliant on employment in heavy industries, with mining and agriculture employing high proportions of the population. This is especially apparent for the Isaac region. This data highlights several unique challenges facing this region regarding digital infrastructure. Both of the Isaac region top industries involve works completed in remote areas that are often under-serviced by digital infrastructure, compared to urban areas.

Other industries that generally had high employment proportions across the MIW region were Healthcare and Social assistance, Education and Training, and Accommodation and Food, all of which can benefit from enhanced digital capabilities in varying capacities.

3 Current digital infrastructure in the MIW region

3.1 Summary of current digital infrastructure

An audit of the current digital infrastructure in the MIW region was undertaken on a technology type basis and a location basis. The digital infrastructure was analysed in detail in the subsequent section.



3.2 Internet access infrastructure

3.2.1 Overview of internet access infrastructure

Internet connection is generally delivered via either wired / fixed line or wireless infrastructure:

Wired / fixed line infrastructure includes:

- **Fibre**

Optical fibre connection including Fibre to the Premises (FTTP), Fibre to the Node (FTTN), Fibre to the Home (FTTH), and Fibre to the Building (FTTB).

- **Digital Subscriber Line (DSL)**

The first generation of broadband utilising the telephone copper wire network. Also referred to as Asymmetric Digital Subscriber Line (ADSL, ADSL2, ADSL2+) and Symmetrical Digital Subscriber Line (SDSL).

- **Cable**

Broadband connection using cable television (CATV) infrastructure. The connection uses a coaxial cable or Hybrid Fibre Coaxial (HFC).

Wireless internet infrastructure includes:

- **Mobile wireless**

An internet connection which provides short range, high data rate connections between mobile data devices and access points connected to a network including 3G/4G accessed through a datacard, USB modem or tablet SIM card.

- **Fixed wireless**

A terrestrial point-to-point microwave or radio link, generally building to building or tower to building.

- **Satellite**

Internet access provided through a satellite.

The Australian Competition and Consumer Commission (ACCC) Internet Activity Report for December 2018 reported that of the broadband connections, most of them are via fibre at 46 per cent followed by DSL at 32 per cent.

3.2.2 Fibre

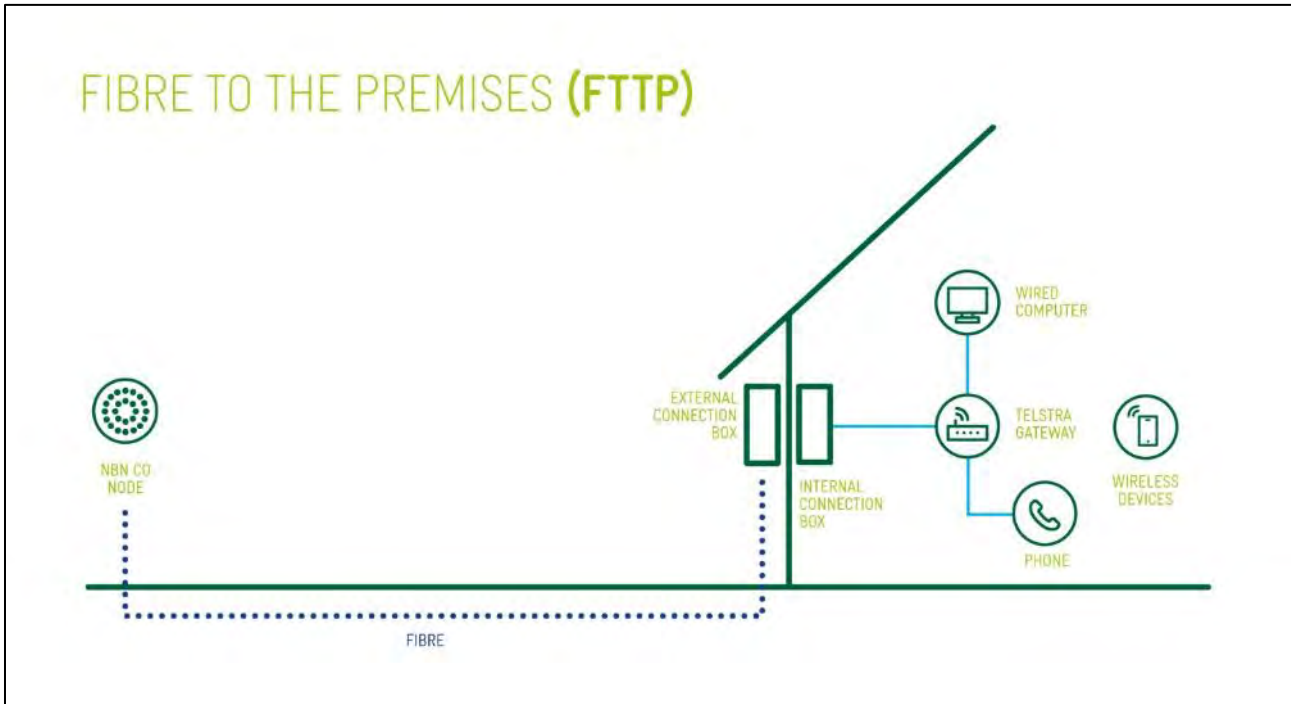
There are number of fibre optic network owner and operators in the MIW region. This is summarised below:

NBN Co fibre network

NBN Co Limited (NBN Co) is a Federal Government owned corporation established to design, build and operate the National Broadband Network (NBN) - a wholesale open-access network. NBN Co was established in 2009 and is wholly owned by the Commonwealth Government as a Government Business Enterprise.

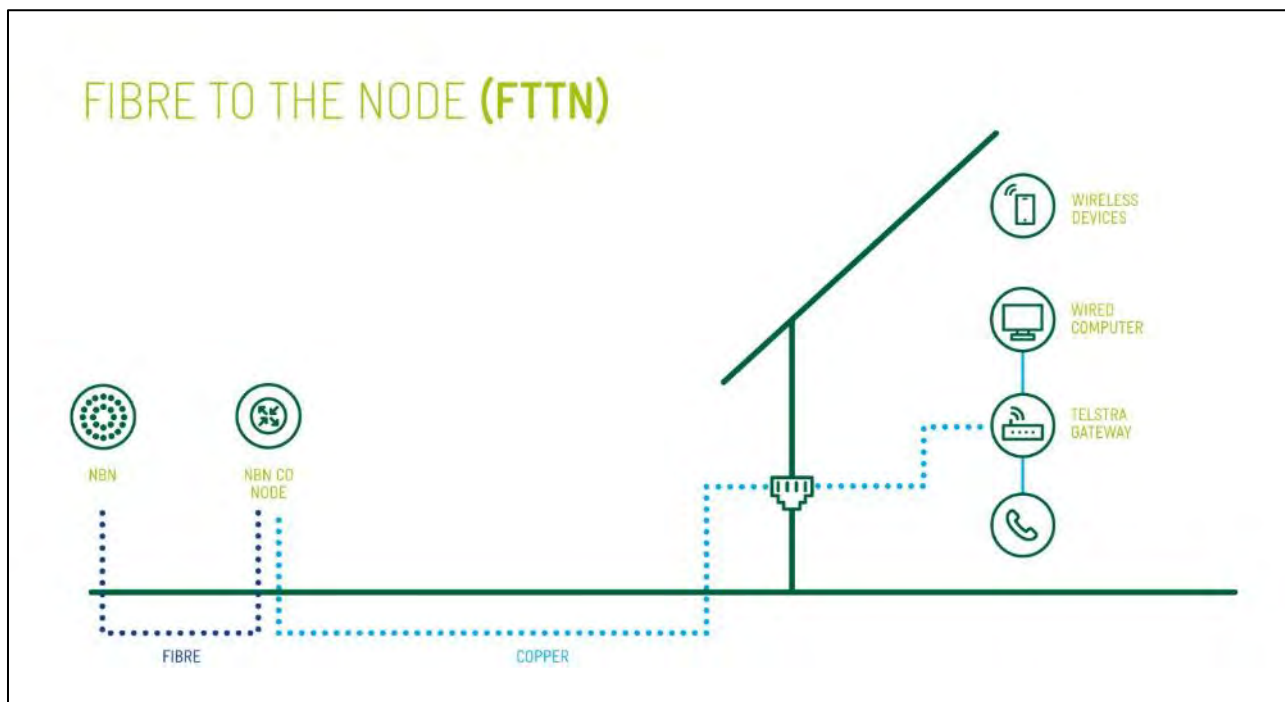
The rollout of the NBN is due for completion in June 2020 with all standard installation premises in Australia able to connect to NBN access network. After June 2020, expansion of the fixed line will switch to a user pays model.

Fibre to the premises (FTTP) and fibre to the node (FTTN) are the two main connections types to the NBN. FTTN technology utilises the existing copper network as opposed to FTTP which brings the fibre to the connection point - see Figure 6 and Figure 7 below.



Source: Telstra <https://www.telstra.com.au/small-business/internet/nbn/getting-connected#fibre-to-the-premises>

Figure 6 Illustration of a FTTP connection



Source: Telstra <https://www.telstra.com.au/small-business/internet/nbn/getting-connected#fibre-to-the-node>

Figure 7 Illustration of a FTTN connection

In general, the NBN rollout is complete across the MIW region. Table 3 below shows the number of premises able to connect to the fixed line NBN and the takeup rates.

Table 3 NBN fixed line premises connections and takeup as of November 2019

LGA	Premises able to connect	Percentage of take up
Mackay	40,446	72.3%
Isaac	5,856 (FTTN only)	61.8%
Whitsunday	12,651	56.9%

Table 4 below details the type of connection available in each LGA. Appendix B contains coverage maps of all the specific areas listed.

Table 4 Snapshot of NBN connection technology per LGA

Technology	Mackay	Isaac	Whitsunday
Fixed line	Mackay city and northern suburbs Walkerston Sarina and beaches Mirani and Marian	Moranbah Dysart Clermont Middlemount	Bowen Airlie Beach Proserpine Collinsville
Fixed wireless	Finch Hatton	-	-
Fixed Wireless and Satellite	Halliday Bay, Ball Bay, Midge Point	Glenden Nebo Coastal communities	Cannonvale
Satellite	-	-	Whitsunday Island

Nexium

Nexium Telecommunications is part of the Yurika group of companies which is owned by Energy Queensland. Nexium uses the Energy Queensland (previously known as Ergon Energy) fibre optic network and is a wholesale provider.

QCN Fibre (previously FibreCo)

QCN Fibre, previously known as FibreCo Queensland, is a State-owned entity owned by Powerlink Queensland and Energy Queensland established in 2019.

QCN Fibre will utilise spare capacity on the government-owned optical fibre network to sell backhaul services to telecommunications companies such as Retail Service Providers and Internet Service Providers. The aim is to encourage competition and deliver better quality internet to regional Queensland.

QCN Fibre's network is mostly above ground optical ground wire cables.

Figure 8 below is a map of QCN Fibre's network.



Source: QCN Fibre

Figure 8 Map of the QCN Fibre network

AARNet

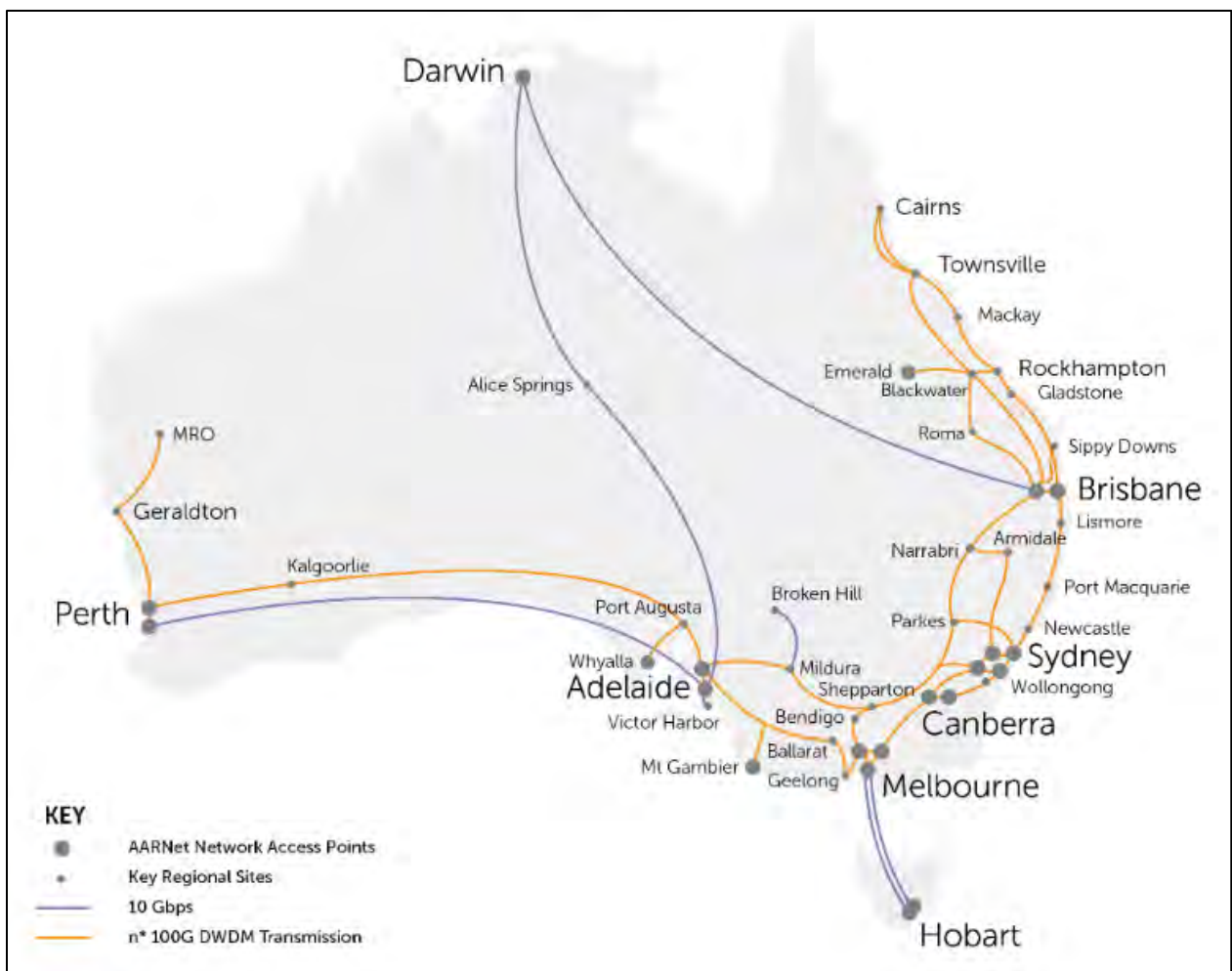
Australia's Academic and Research Network (AARNet) is a not-for-profit National Research and Education Network (NREN). This is owned by 38 Australian universities and Commonwealth Scientific and Industrial Research Organisation (CSIRO).

AARNet's customers include the shareholder universities and CSIRO, as well as most of the publicly funded research agencies, state government agencies, schools, TAFEs and hospitals, and state and federal galleries, libraries, archives and museums. AARNet is also a retail service provider for the NBN and provides eduRoam is a secure global Wi-Fi roaming service.

AARNet owns an optical fibre network that runs along the east coast with the following connections in the MIW region to:

- CQUni - Mackay City and Ooralea campuses
- James Cook University - Mackay campus

Figure 9 below is a map of AARNET's network.



Source: AARNET

Figure 9 Map of the AARNET network

Queensland Rail and Aurizon

Queensland Rail owns and operates a Telecommunications Backbone Network (TBN). The TBN is supplemented by external services and is used to support Queensland Rail's operational and business communications. Queensland Rail have a commercial service offering tower and corridor access, managed data services and dark fibre.

Aurizon (within the Central Queensland Coal Network) own and operate a network of optical fibre and microwave radio systems which is primarily to service the rail operation/s. Aurizon also have a number of hilltop sites outside the rail corridor. Aurizon provides a range of wholesale services with access to dark fibre and radio communications towers.

Local government owned fibre network

Mackay Regional Council

Mackay Regional Council own a fibre optic network as shown in the aqua line in Figure 10 below. The network is connected to the main Council offices and depot in the Mackay urban area.



Source: MiMaps 2019

Figure 10 Mackay Regional Council fibre optic cable network

3.2.3 Digital Subscriber Line (DSL)

The first generation of broadband utilised the telephone copper wire network. Also referred to as Asymmetric Digital Subscriber Line (ADSL, ADSL2, ADSL2+) and Symmetrical Digital Subscriber Line (SDSL).

ADSL was the first generation of broadband utilising the telephone copper wire network. ADSL is common in regional and rural areas however this is slowly being replaced by NBN services.

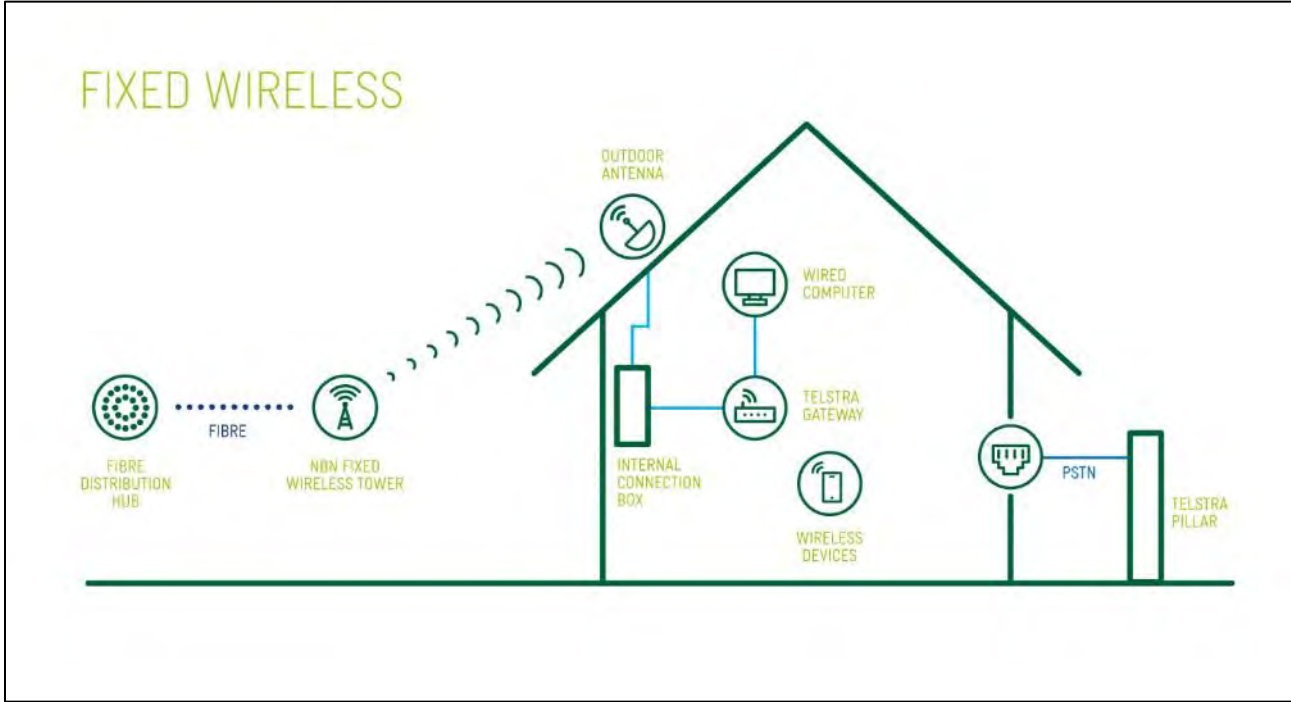
3.2.4 Cable

Cable broadband connection is similar to DSL but uses the cable television (CATV) infrastructure. The connection uses a coaxial cable or Hybrid Fibre Coaxial (HFC). Cable connection is a faster signal transmission than the copper network.

3.2.5 Fixed wireless

The NBN uses fixed wireless communications links to provide high-speed broadband in some areas beyond the reach of fixed-line infrastructure.

Fixed wireless technology uses data transmitted over radio signals to connect premises to the NBN broadband access network as outlined in Figure 11 below.



Source: Telstra <https://www.telstra.com.au/small-business/internet/nbn/getting-connected#fixed-wireless>

Figure 11 Illustration of a fixed wireless connection

Fixed wireless coverage in the MIW region

Fixed wireless coverage is generally available in the rural communities and small towns in the MIW region. Table 5 below shows the number of premises able to connect to the fixed line NBN and the takeup rates.

Table 5 NBN fixed wireless premises connections and takeup as of November 2019

LGA	Premises able to connect	Percentage of take up
Mackay	9,780	51%
Isaac	580	19%
Whitsunday	5,631	38%

Table 6 below details the type of connection available in each LGA. Appendix B contains coverage maps of all the specific areas listed.

Table 6 Snapshot of NBN connection technology per LGA

Technology	Mackay	Isaac	Whitsunday
Fixed wireless	Finch Hatton	-	-
Fixed Wireless and Satellite	Halliday Bay, Ball Bay, Midge Point	Glenden Nebo Coastal communities	Cannonvale

3.2.6 Satellite

The satellite internet services offered via the NBN is the Sky Muster service. This is summarised and evaluated in detail below.

NBN Sky Muster

NBN Co provides the Sky Muster satellite service to regional and remote areas, via two state-of-the-art satellites. The service requires a roof satellite and an NBN supplied modem to be installed at the premises where the broadband is required.

In 2019, NBN Co launched Sky Muster Plus which offers an un-metered service.

Satellite coverage in the MIW region

NBN Co satellite services are available in areas where fixed line or fixed wireless is not. Of the main population areas Glenden, Nebo and the Isaac LGA coastal communities are reliant on satellite services as well as the Whitsunday Islands.

Appendix B contains coverage maps of the following areas within the MIW region:

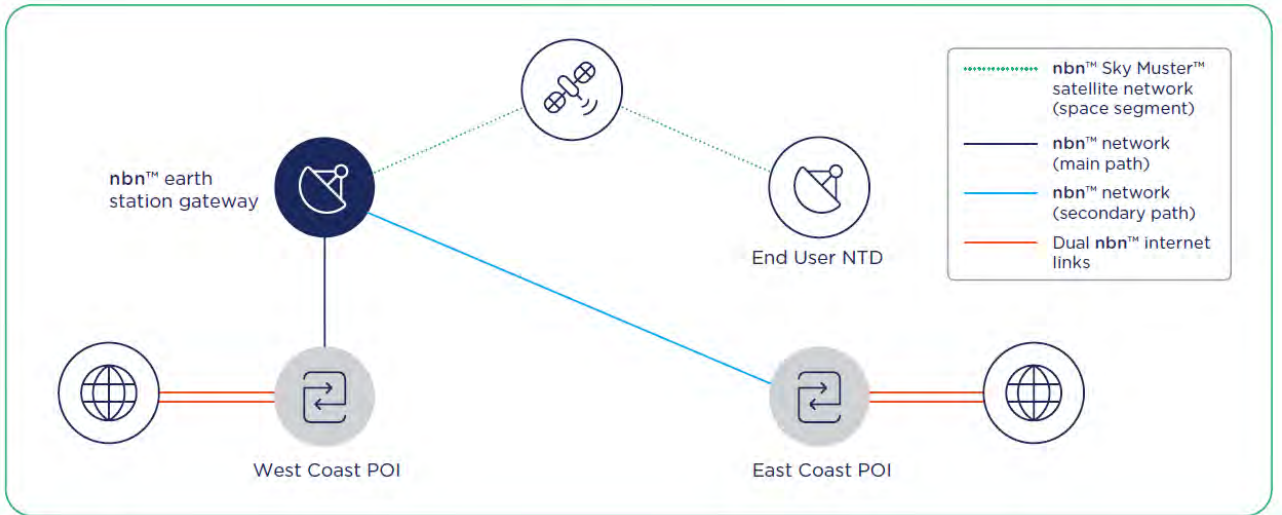
Mackay	Isaac	Whitsunday
<ul style="list-style-type: none"> ■ Mackay City & Northern Beaches ■ Mackay -southern suburbs ■ Walkerston ■ Seaforth & Ball Bay ■ Midge Point 	<ul style="list-style-type: none"> ■ Glenden ■ Nebo ■ Moranbah ■ Dysart ■ Middlemount ■ Isaac coastal communities 	<ul style="list-style-type: none"> ■ Bowen ■ Airlie Beach & Cannonvale ■ Proserpine

Business NBN satellite service

On 31 October 2019, NBN Co announced a new business unit for regional and remote customers and a business satellite service.

The business satellite service is a wholesale service aimed at medium and large businesses. The service will offer several new products:

- **a virtual ISP (VISP) service** enabling access to cloud-based apps, eCommerce and voice
- **an IoT service** offering low speed connections
- **an access bandwidth service** aimed at enterprise and government customers who require a committed information rate bandwidth profile



Source: NBN Co <https://www.nbnco.com.au/business/product-and-technical-information/business-satellite-service/virtual-isp>

Figure 12 Network schematic for a VISP or IoT service

3.3 Mobile network

3.3.1 Overview

A mobile phone network is defined as a communication network where the last link is wireless and is based on a network of base stations.

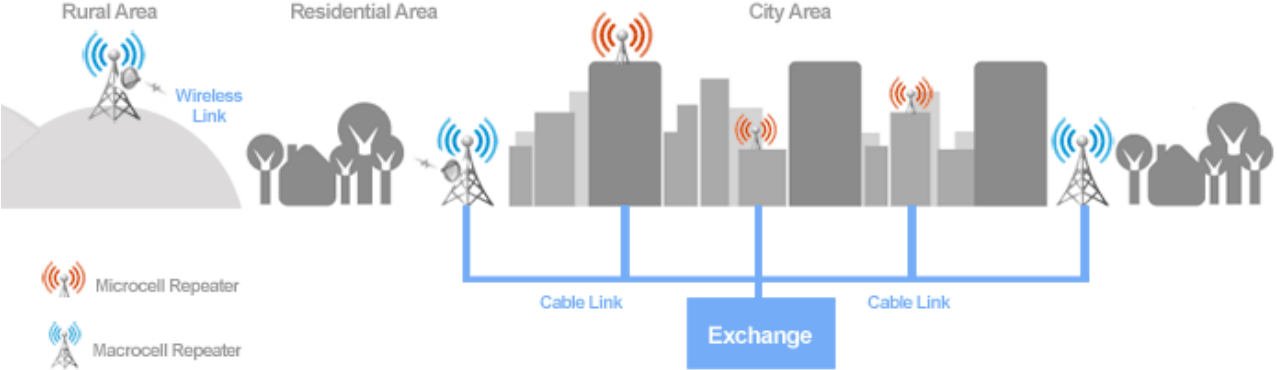
A mobile base station is made up of antennas either on a mast, tower or building with fixed line or wireless back to the exchange as outlined in Figure 13 below.



Source: Radio Frequency National Site Archive <https://www.rfnsa.com.au>

Figure 13 Example rooftop, pole and tower base stations

The antennas are generally microcell or microcell technology. In denser urban areas, microcell antennas are usually located only hundreds of metres apart to ensure that there is enough network capacity. In suburban settings, antennas are typically several kilometres apart, and in rural areas up to 30 km apart. Figure 14 below illustrated a typical mobile network.



Source: Mobile Network Guide mobilenetworkguide.com.au/mobile_base_stations.html

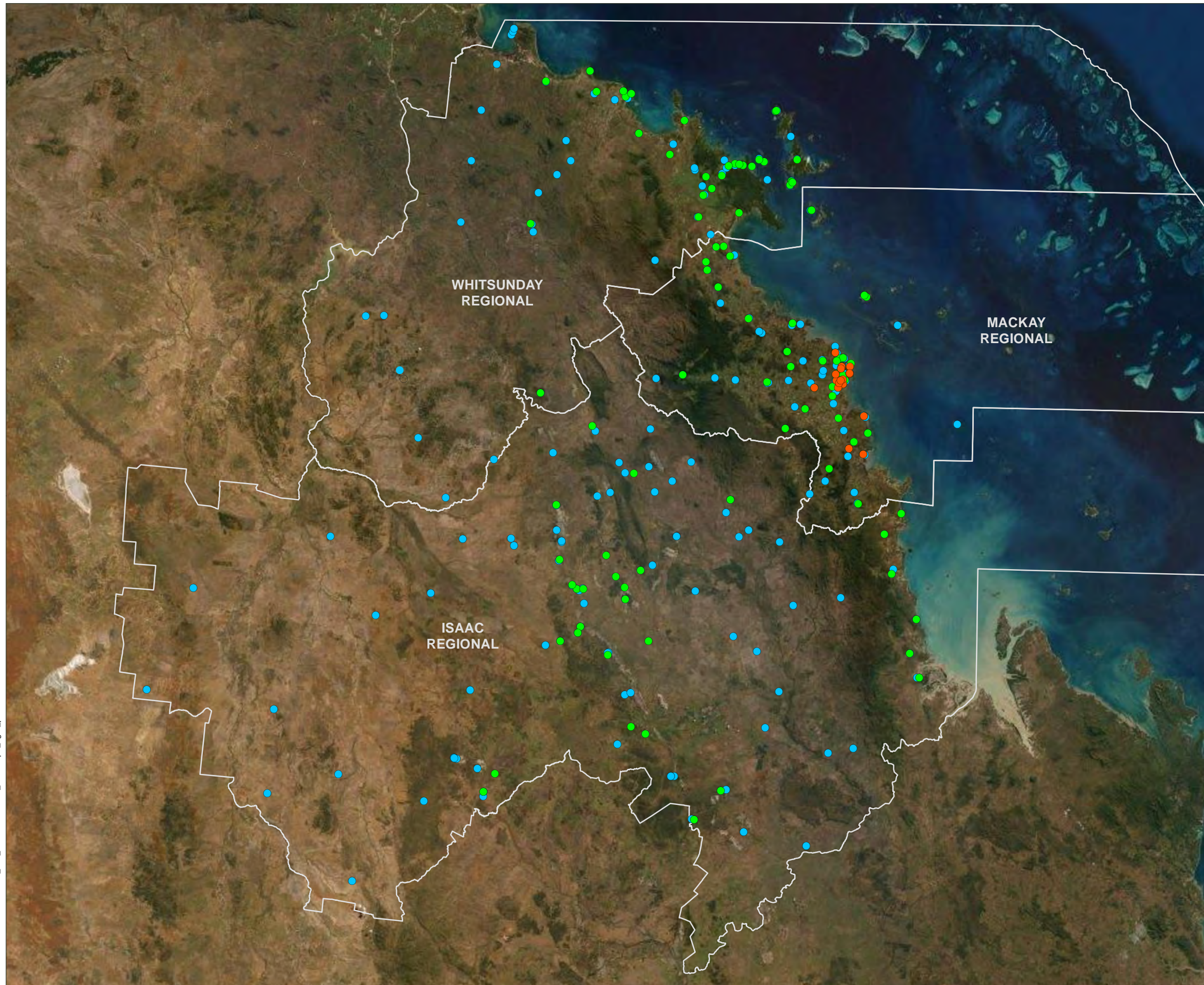
Figure 14 Diagram of a typical mobile network

In Australia, there are three major carriers for mobile networks. This includes Telstra, Optus and Vodaphone. There are other smaller companies within Australia that utilise the networks of these three major companies known as mobile virtual network operators.

3.3.2 Mobile network coverage in the MIW region

Base station network

Figure 15 to Figure 18 below show the location of the mobile base stations in the MIW region. A number of the base stations host equipment owned by the other carriers.



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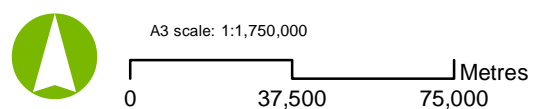
- Optus_Vodafone
- Optus
- Telstra
- Local Government Areas

Notes:

Date: 4/12/2019

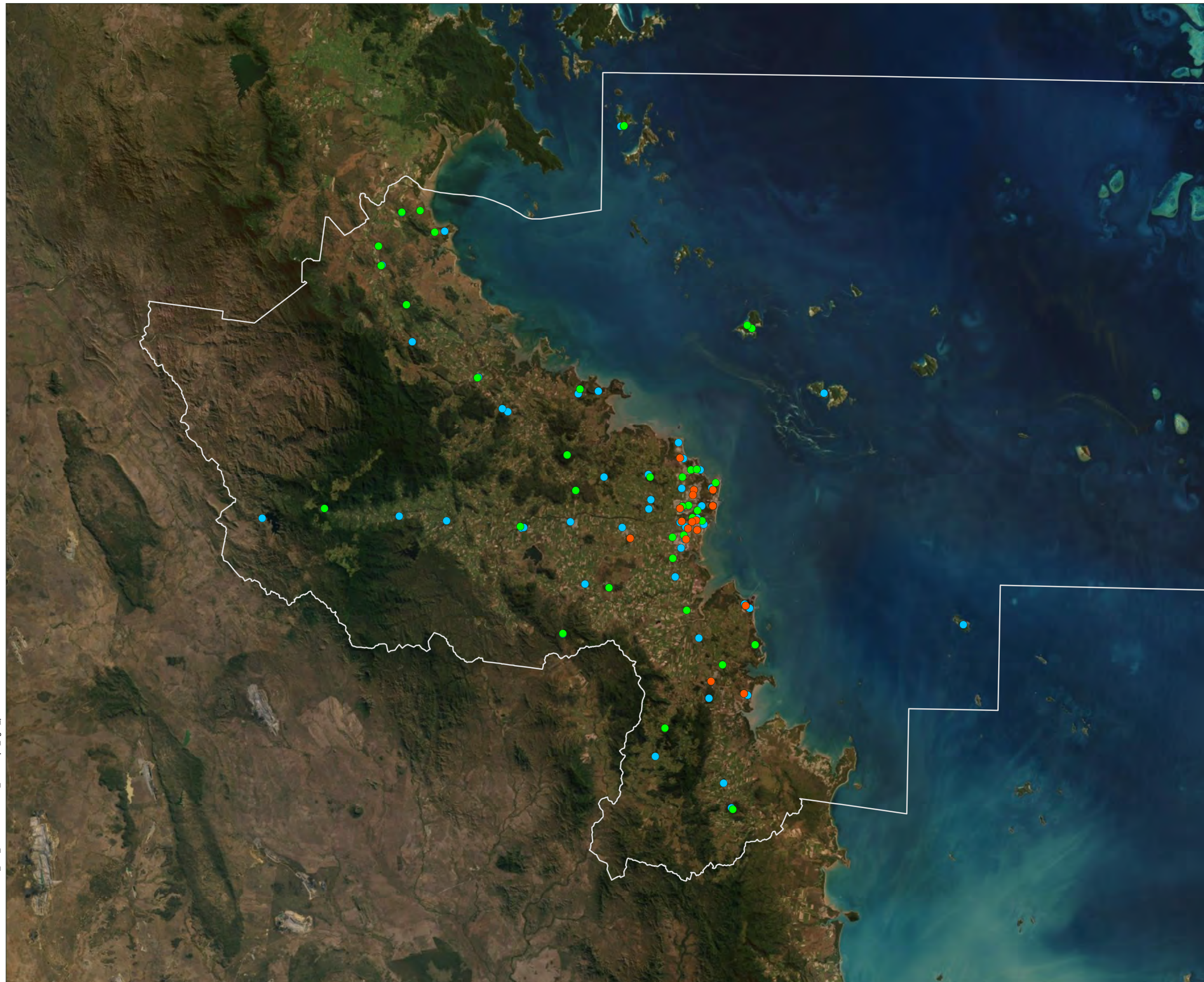
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Figure 15: Location of Mobile Base Stations by Owner in the MIW Region



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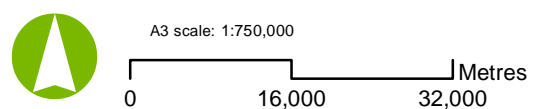
- Optus Vodafone
- Optus
- Telstra
- Local Government Areas

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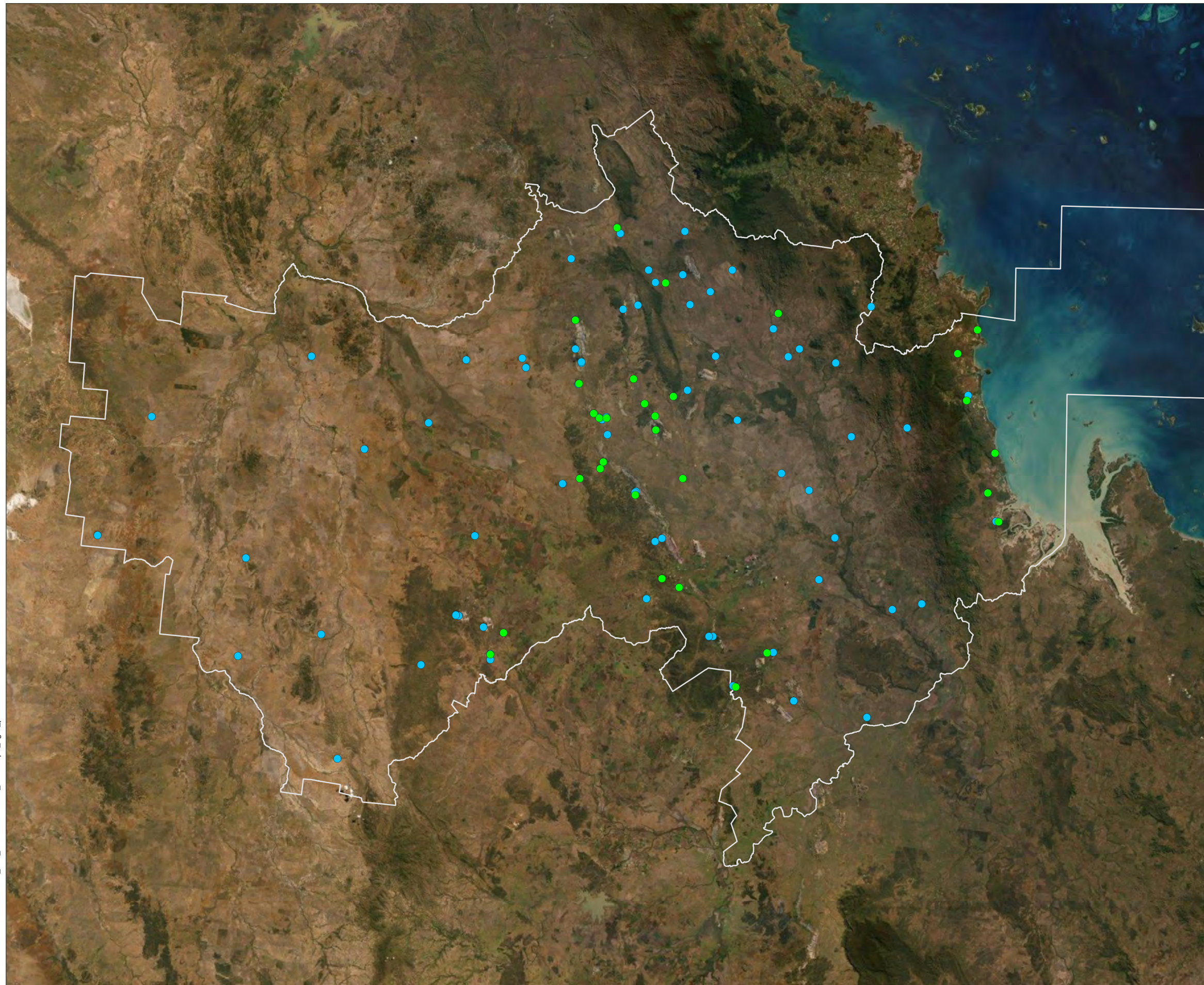
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Figure 16: Location of Mobile Base Stations by Owner in the Mackay LGA Map



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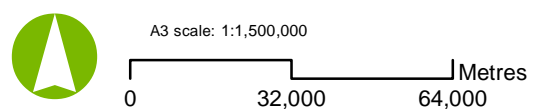
- Optus
- Telstra
- Local Government Areas

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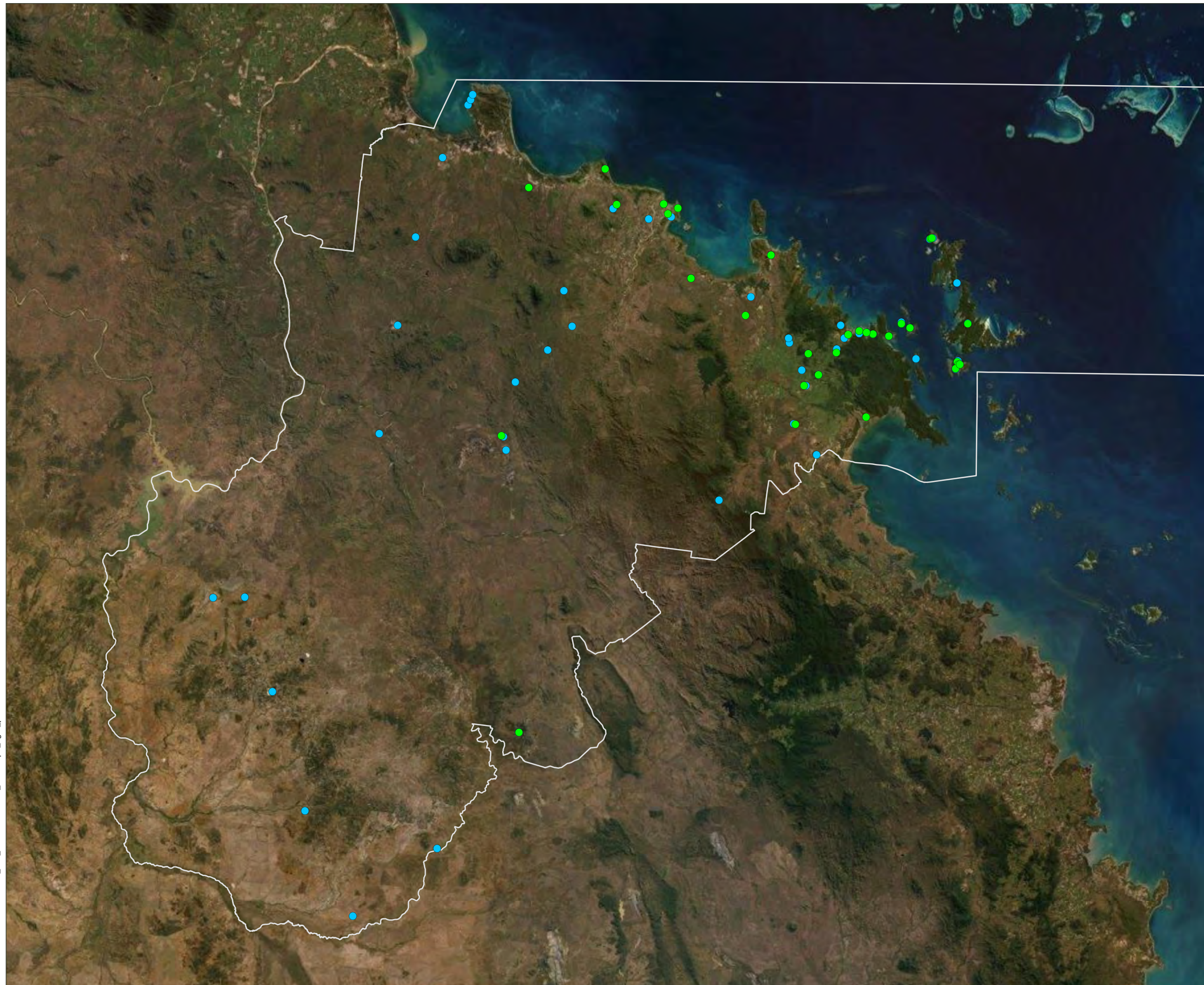
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MIW Digital Infrastructure Study **Blackspots**

Figure 17: Location of Mobile Base Stations by Owner in the Isaac LGA Map



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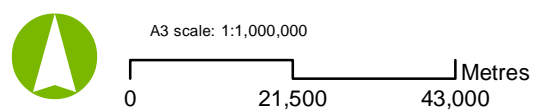
- Optus
- Telstra
- Local Government Areas

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Coordinate System: GDA 1994 MGA Zone 55

Telstra

Based on the coverage maps available, Telstra 3G and 4G coverage is generally available in all urban areas.

In February 2020, Telstra has rolled out 5G coverage in Mackay. The coverage covers the Mackay CBD, North Mackay, South Mackay and parts of Paget. Figure 19 below shows the coverage as of February 2020.

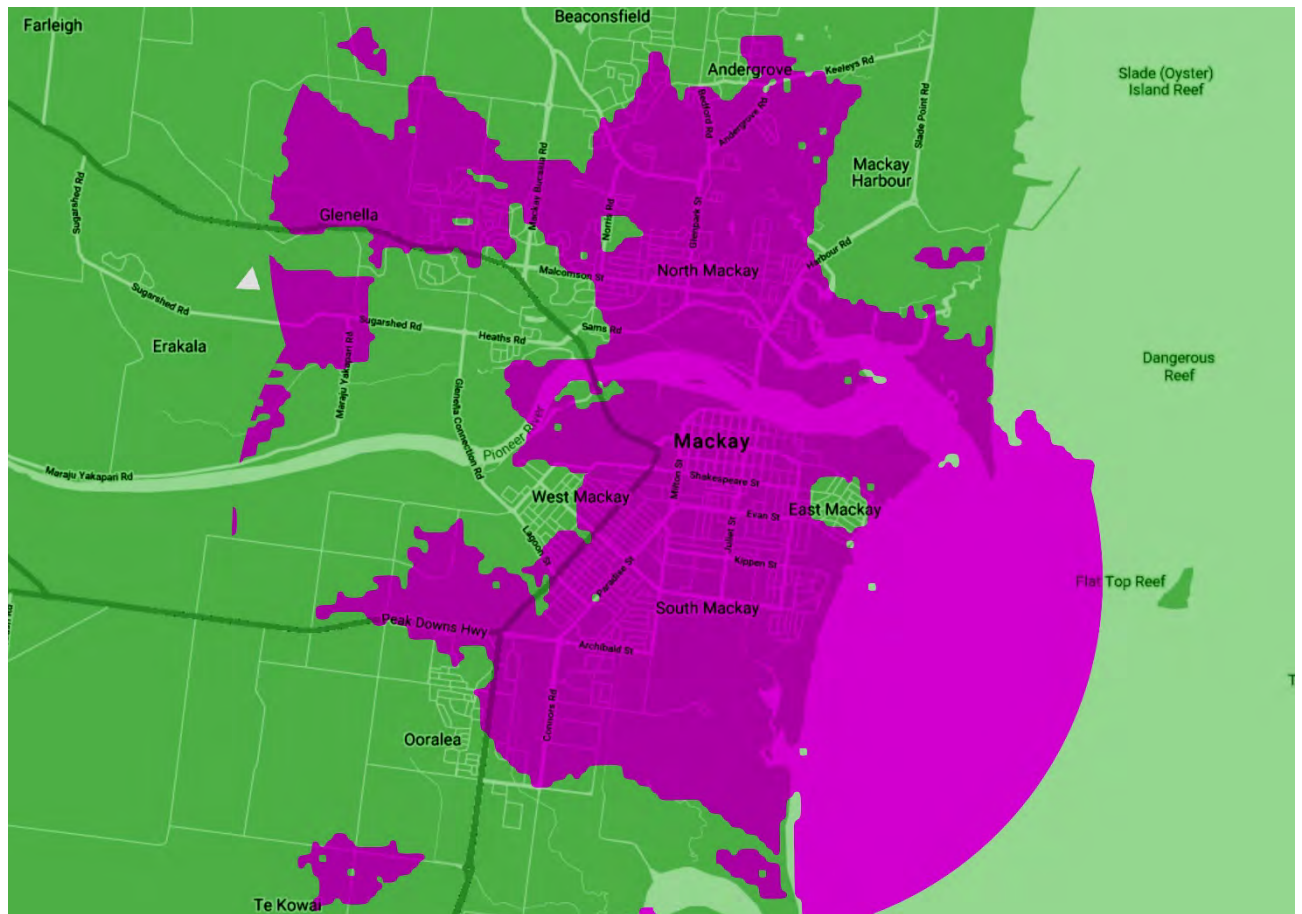


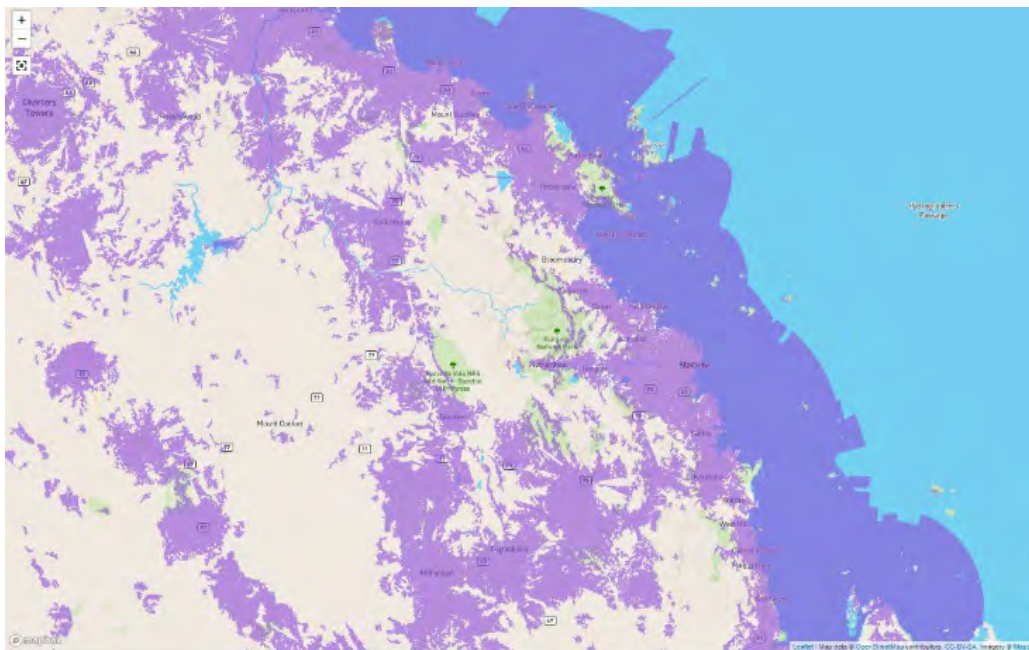
Figure 19 Telstra 5G coverage map

Figure 19 compares Telstra's 3G and 4G coverage. There are several areas where there is 3G coverage only that will require upgrades to 4G when the 3G is switched off in 2024 including Bloomsbury and Mount Coolon.

Telstra 3G coverage



Telstra 4G coverage



Source: Whistle Out <https://www.whistleout.com.au/MobilePhones/Guides/who-has-the-best-mobile-coverage>

Figure 20 Telstra 3G and 4G coverage maps

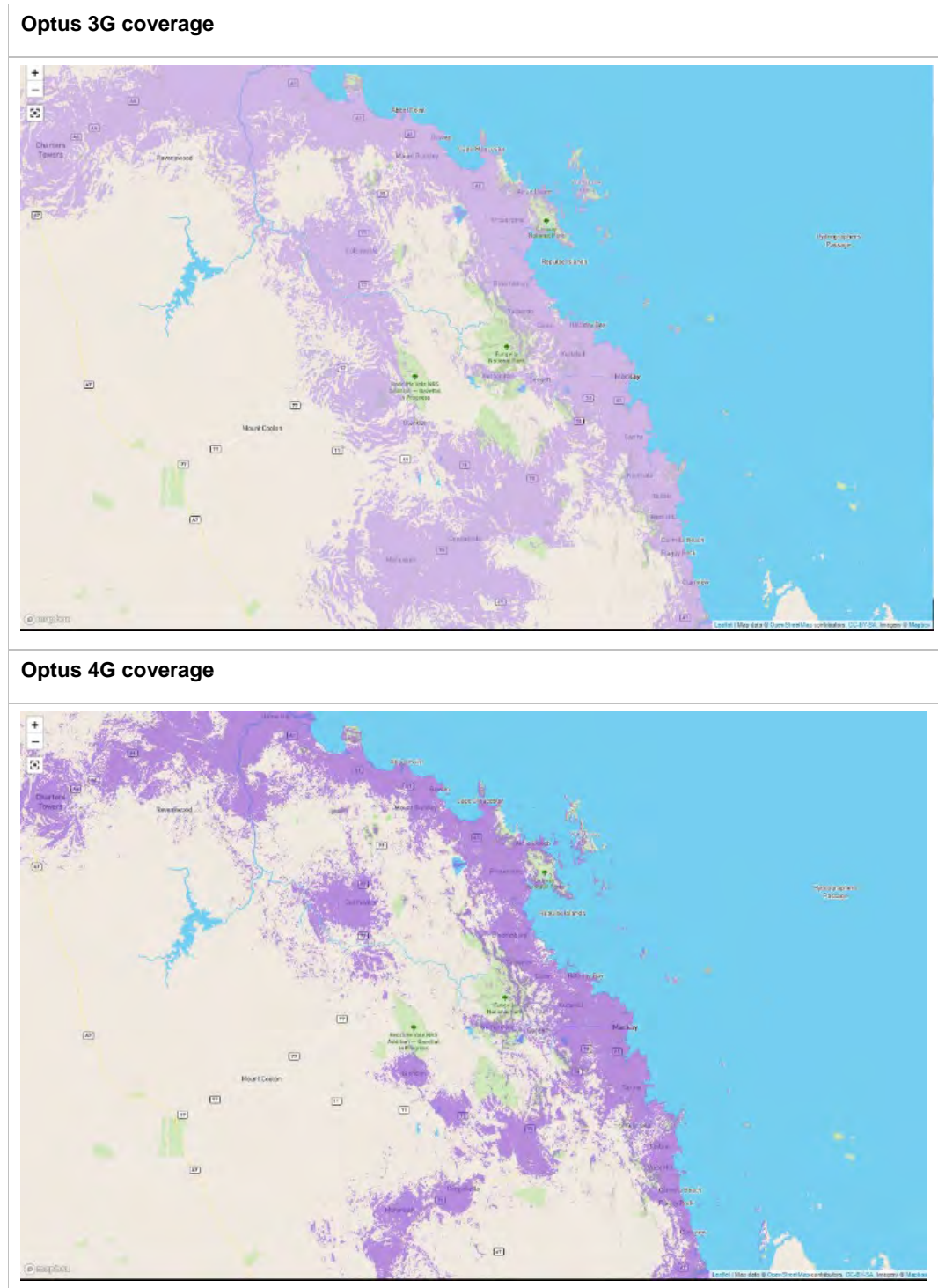
Optus

Based on the coverage maps available, Optus 3G and 4G coverage is generally available in all urban areas. Figure 20 compares Optus' 3G and 4G coverage.

There are several areas where there is 3G coverage only that will require upgrades to 4G when the 3G is made redundant including Koumala. Optus have identified Hamilton Island and the outskirts of Moranbah as priority sites as well as the accommodation camps servicing the mining areas.

Optus has recently starting marketing a Cel-Fi repeater product in Mackay. The product is designed for the 3G and 4G network and increase indoor coverage.

Optus has started to rollout their 5G network which is now available in selected areas in Brisbane, Queensland. Optus have indicated that a 5G rollout in regional Queensland is not likely in the next 3 years.

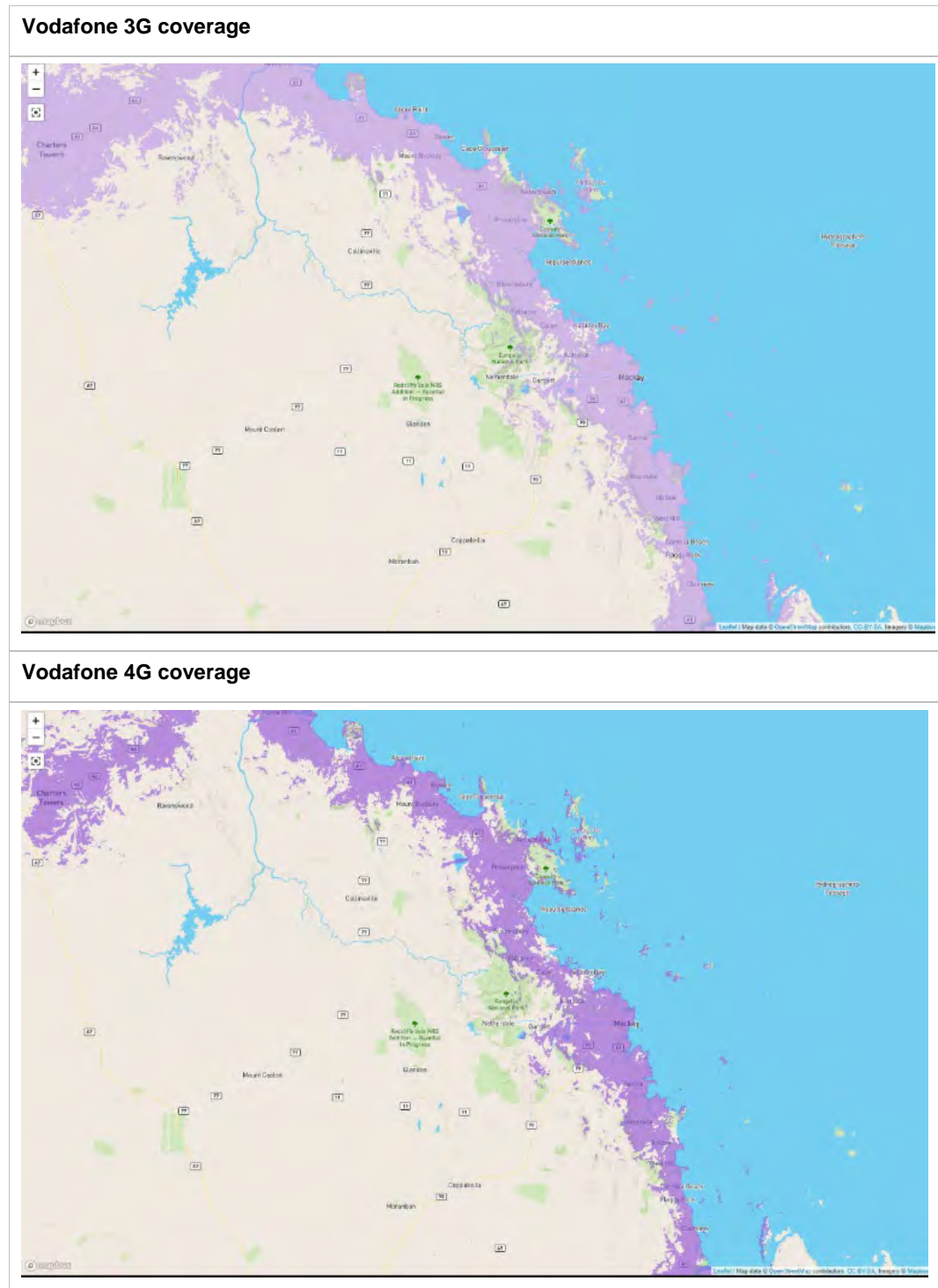


Source: Whistle Out <https://www.whistleout.com.au/MobilePhones/Guides/who-has-the-best-mobile-coverage>

Figure 21 Optus 3G and 4G coverage maps

Vodafone

Based on the coverage maps available, Vodafone 3G and 4G coverage is generally available only in the coastal urban areas. Figure 21 compares Vodafone's 3G and 4G coverage.



Source: Whistle Out <https://www.whistleout.com.au/MobilePhones/Guides/who-has-the-best-mobile-coverage>

Figure 22 Vodafone 3G and 4G coverage maps

Blackspots

The Mobile Black Spot Program (MBSP) is a co-investment program administered by the Commonwealth Government with the aim of improving mobile coverage in Australia. Sites are nominated by the three carriers and can include funding support from State and local governments.

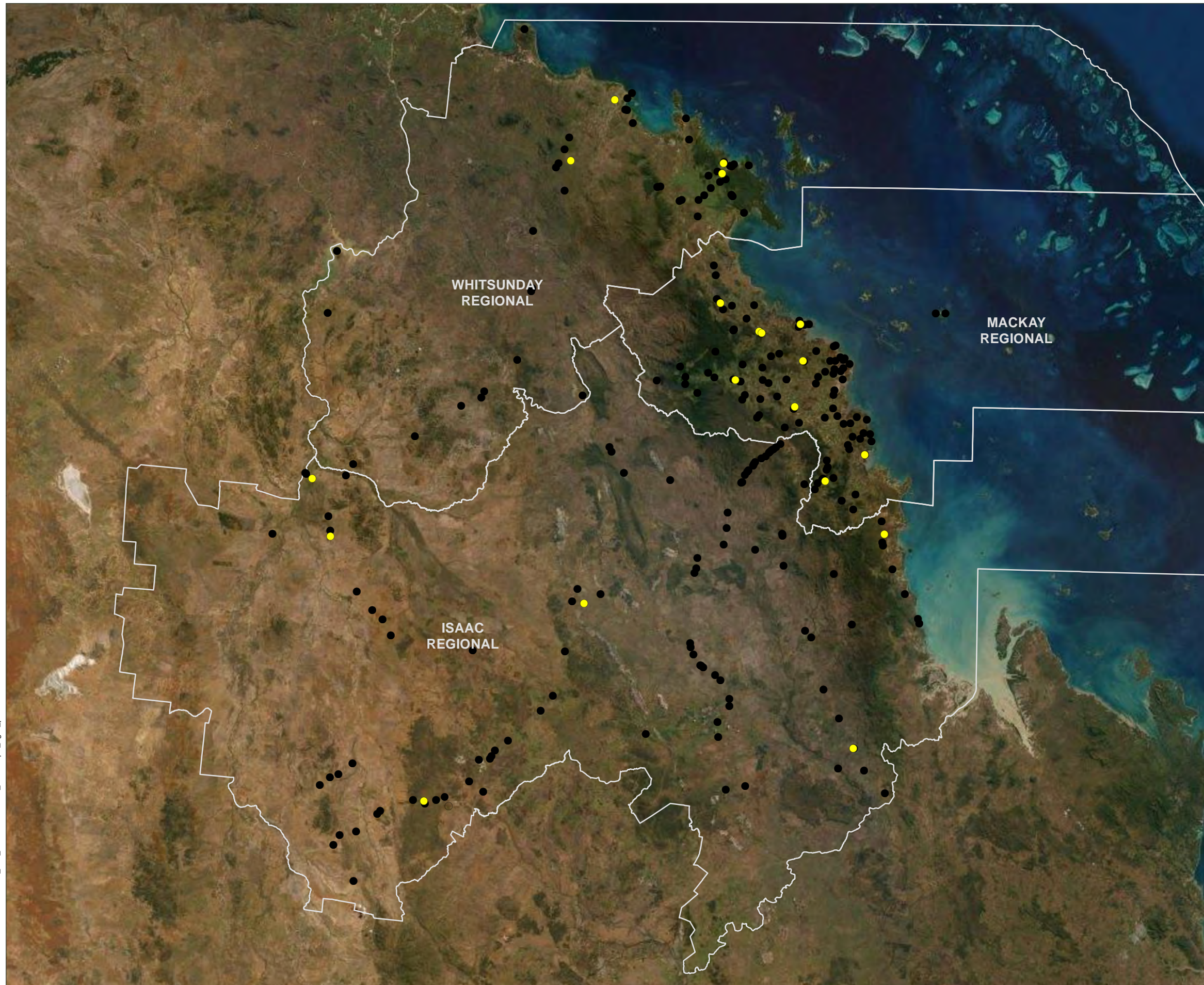
In addition to the MBSP, the Queensland Government has a co-funding arrangement with Telstra for 78 Telstra 4G small cells.

To date there has been 4 rounds of MBSP funding with 12 sites in the MIW region granted funds. This is outlined in Table 7 below. Round 5 funding is due to be announced in early 2020 and it is expected that future rounds will be re-structured following the response to the 2018 Regional Telecommunications Review.

Table 7 Funded mobile black spot program sites in the MIW region

Location	Applicant	LGA	Round
Mistake Creek (PIP)	Telstra	Isaac	Round 4
Mount Ossa	Telstra	Mackay	Priority Locations (Round 3)
Clermont	Telstra	Isaac	Priority Locations (Round 3)
Koumala/Sarina Range	Telstra	Mackay	Priority Locations (Round 3)
Yalbaroo	Telstra	Mackay	Priority Locations (Round 3)
Bowen Development Road	Telstra	Isaac	Round 2
Gregory Developmental Road A	Telstra	Isaac	Round 2
West Hill	Optus	Isaac	Round 2
Woodwark	Telstra	Whitsunday	Round 2
Bowen Developmental Road	Telstra	Whitsunday	Round 1
Clarke Creek	Telstra	Isaac	Round 1
Gargett	Telstra	Mackay	Round 1

Figure 22 to Figure 25 show the locations of the funded and reported blackspots in the MIW region.



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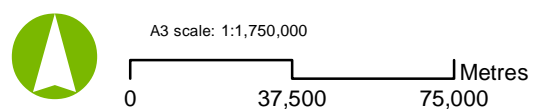
- MIW Funded Blackspot Sites
- Reported Mobile Blackspots
- Local Government Areas

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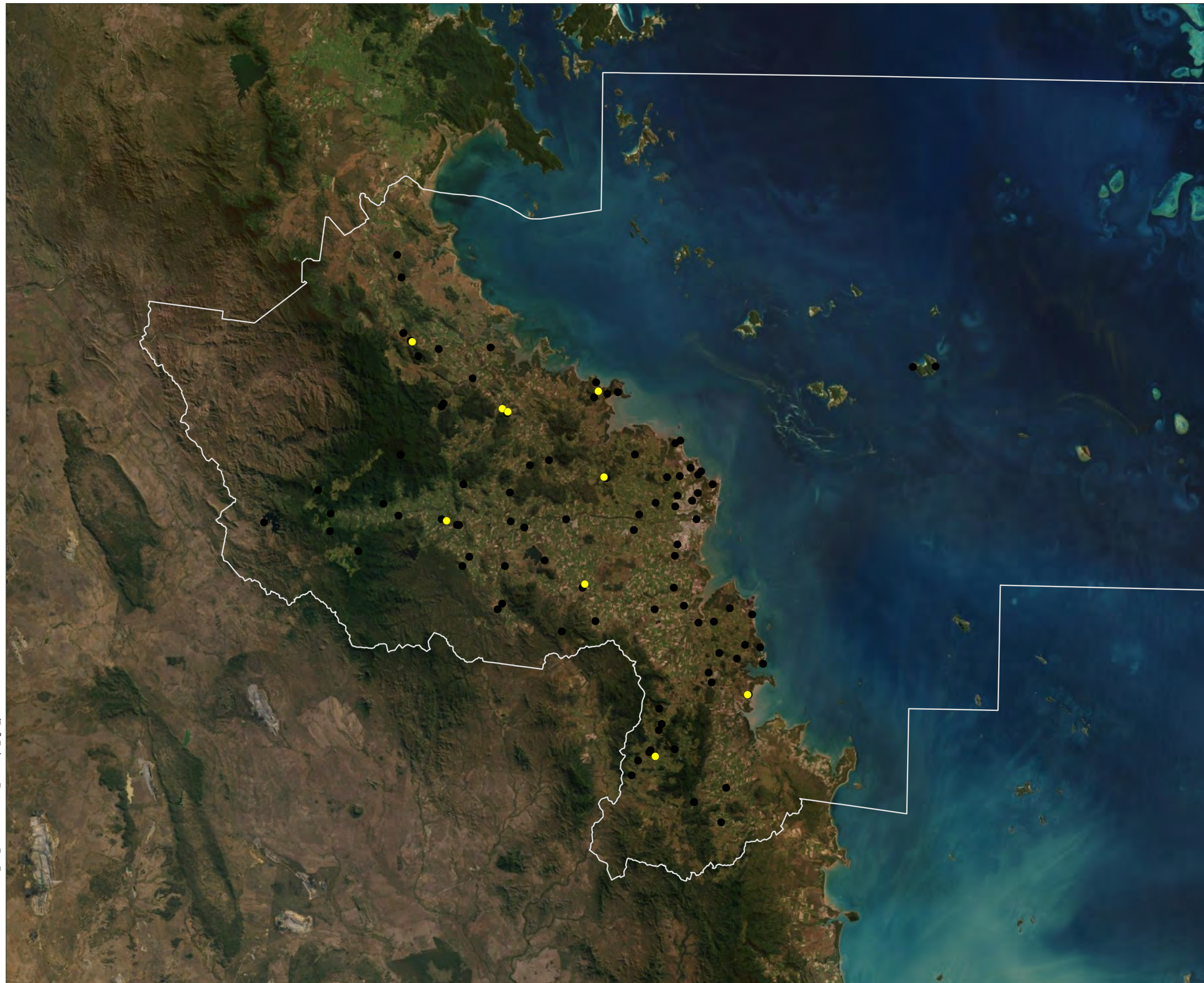
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Figure 23: Reported Mobile Blackspots and Mobile Blackspot Program funded Sites in the MIW Region



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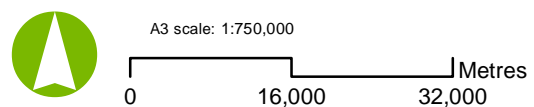
- MIW Funded Blackspot Sites
- Reported Mobile Blackspots
- Local Government Areas

Notes:

Date: 4/12/2019

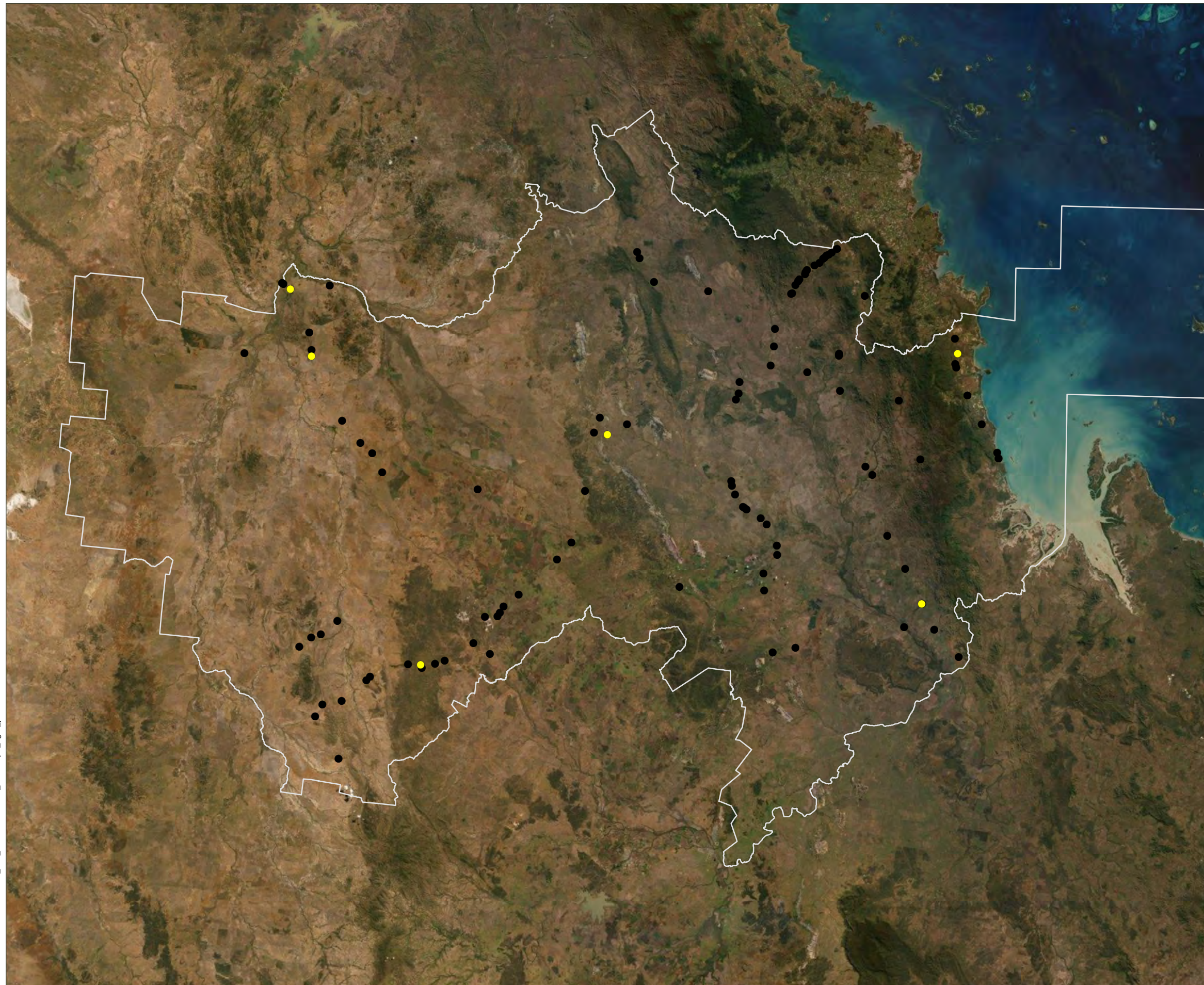
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Job No:
Coordinate System: GDA 1994 MGA Zone 55

Figure 24: Reported Mobile Blackspots and Mobile Blackspot Program Funded Sites in the Mackay LGA Map



Legend

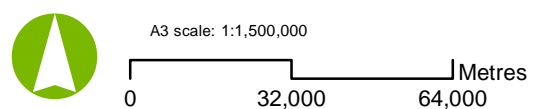
- MIW Funded Blackspot Sites
- Reported Mobile Blackspots
- Local Government Areas

Notes:

Date: 4/12/2019

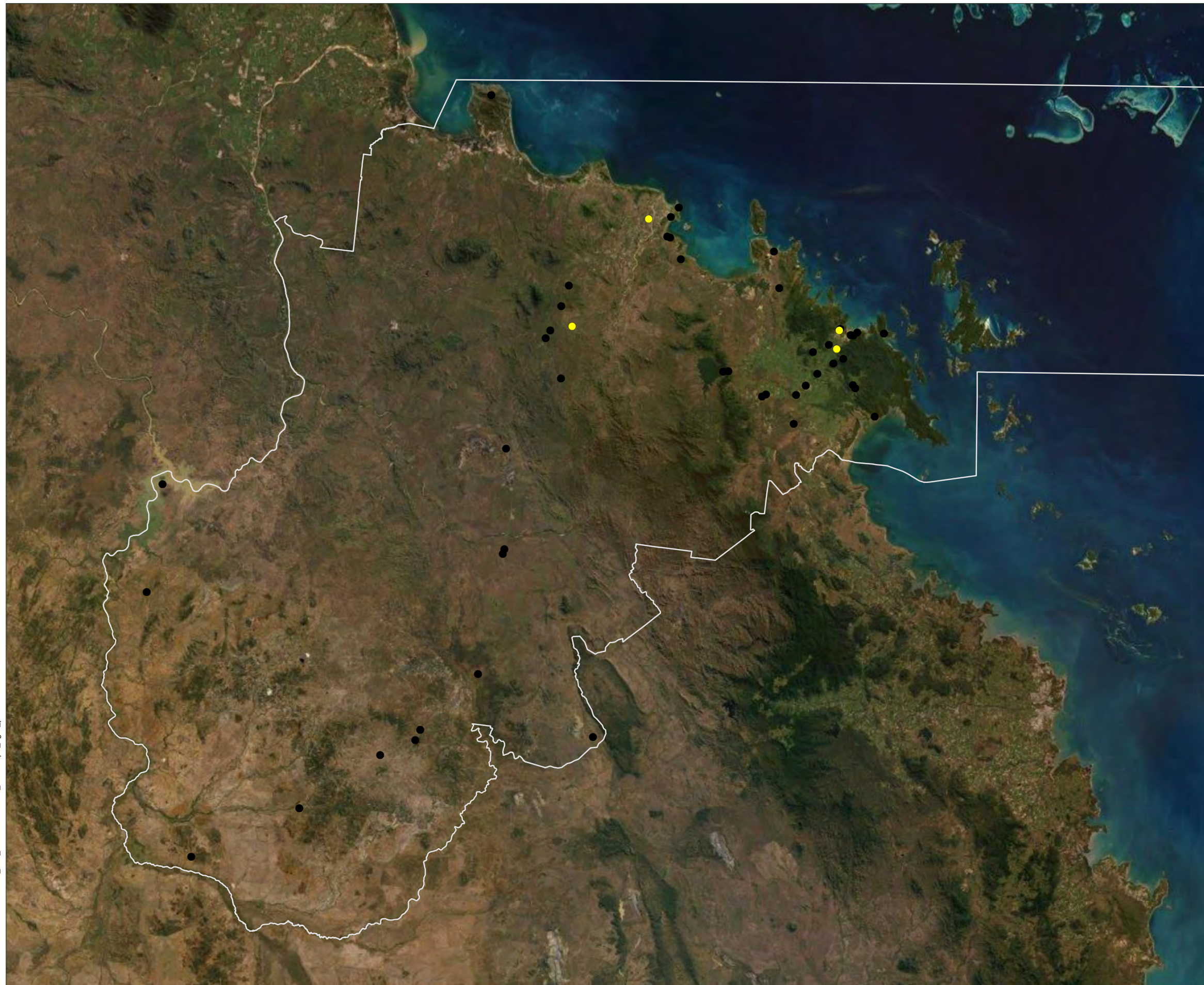
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Job No:
Coordinate System: GDA 1994 MGA Zone 55

Figure 25: Reported Mobile Blackspots and Mobile Blackspot Program Funded Sites in the Isaac LGA Map



Legend

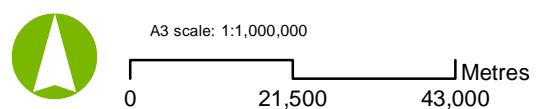
- MIW Funded Blackspot Sites
- Reported Mobile Blackspots
- Local Government Areas

Notes:

Date: 4/12/2019

Version: 1

Author: P:\GISR_and_D\Aurecon\10\A3_landscape_right_panel.mxd 24/05/2012 14:18



Job No:
Coordinate System: GDA 1994 MGA Zone 55

Figure 26: Reported Mobile Blackspots and Mobile Blackspot Program Funded Sites in the Whitsunday LGA Map

In 2016, consultants Digital Economy produced a mobile phone and device black spots connectivity assessment for Whitsunday ROC for the MIW region. The reports identified blackspots with potential for further investigation for a MBSP funding application.

Table 8 Mobile blackspots in the MIW region as per the 2016 Digital Economy Group assessment

Mackay	Isaac	Whitsunday
Kuttabul	Peak Downs Highway between the retreat and the Mt Spencer turnoff	Bowen Developmental Rd between Collinsville and Mt Coolon
Pinevale		
Mount Charlton	Fitzroy Development Road between Middlemount and Nebo	Bowen Developmental Rd - North, South and West of Mt Coolon
Mount Ossa		
Gargett (funded in Round 1 of the MBSP)	Gregory Development Rd from Belyando Crossing to 60klms north of Clermont	Bowen Developmental Rd between Bowen and Collinsville (funded in Round 1 of the MBSP)
Eungella		
Sarina Range - Sarina-Marlborough Road		
Middle creek Dam - west of Sarina		

It was identified the blackspots are concentrated around the road network. Additionally, the Whitsunday Charter Boat Industry Association identified a black spot on the western side of the Whitsunday Islands.

Feedback from tourism industry stakeholders noted that lack of mobile coverage as a guest safety issue. Mobile blackspots were also thought to have had an impact on business as it can decrease social media sharing.

3.4 Private networks

3.4.1 Overview

Similar to the public Long-Term Evolution (LTE) networks provided by Telstra, Optus and Vodafone, private LTE networks can provide services like voice, broadband data, Push To Talk (PTT), and IoT.

Private LTE networks are smaller in capacity and footprint than public LTE networks. The advantage of a private LTE network is higher quality of service, and high reliability, availability and security. These networks are typically used by emergency services authorities, mining corporations, utilities and farmer’s cooperatives.

Telstra LANES (LTE Advanced Network for Enterprise Services) is targeted at resource, mining and utilities companies. The service offers a dedicated, portioned LTE spectrum for exclusive use with extra capacity on the Telstra Mobile Network with the option of traffic priority in LTE enabled areas. Case studies where successful implementation of private networks are summarised below.

Case study - CPB Contractors Mackay Ring Road private network

marchnet.com.au/2018/09/13/cpb-mackay/

CPB Contractors is working with the Department of Transport and Main Roads to deliver Stage 1 of the Mackay Ring Road.

The CPB Mackay office was challenged with no access to Fibre services available in Mackay. The only services available, were highly contested 3G/4G mobile services with wireless dongles and small download packages, causing low productivity for the onsite staff.

March IT delivered a 10Mbps/10Mbps private data service to the CPB Mackay Ring Road office. These services were delivered over Fixed Wireless technologies and connected back to the CPB private network in Brisbane.

Case study - Stirlings to Coast Farmers private network

pivotel.com.au/wp-content/uploads/2019/06/Pivotel-Case-Studies-Stirlings-To-Coast-Farmers.pdf

Stirlings to Coast Farmers (SCF) represents farmers in the lower Great Southern coastal region of Western Australia. Stirlings to Coast Farmers partnered with **Pivotel** to establish a customised, private LTE network to provide mobile coverage to farmers.

Pivotel was awarded two grants by the WA Department of Primary Industries and Regional Development through the [Digital Farm Grants Program](#) to build two ecoSphere® high speed 4G cellular networks in the regions of Mt Barker and Wickiepin.

Pivotel's 4G network will connect farms using a series of cellular base stations that are installed on towers across these properties. The ecoSphere® network supports connectivity to IoT devices used on farms to gather sensor reports on water levels, soil moisture, weather conditions and other important environmental and agricultural measures.

Pivotel and SCF are predicting there will be 50 farms connected as part of this first stage of the SCF Digital Farms initiative by the end of 2019.

3.5 Global Navigation Satellite System (GNSS)

3.5.1 Overview

Global Navigation Satellite System (GNSS) technology is utilised to determine position, velocity and time. Global Positioning System (GPS) is a widely used navigation network and is one of many GNSS.

A Differential GPS Receiver (DGPS) is a type of receiver with a fixed, ground-based reference station which corrects errors of the original GPS signal. Real-Time Kinematic (RTK) differential receivers are a type of DGPS where signals come from a local base station in real time. These base stations generally have a range limited to 30 km or less, though can locate to within 2-10cm accuracy. RTK is the most common GPS application in precision agriculture.

3.5.2 Mackay Sugar

Based on the *Sugar GPS Coordination Applications and Future Directions* paper presented at the *6th Australian Controlled Traffic Farming Conference* in 2008, Mackay Sugar has an existing network of GPS base stations.

In 2005, Mackay Sugar introduced GPS tracking of 164 harvesting groups across 1480 cane farms. By 2008, 51 harvesters had been fitted with GPS units (refer to Figure 26 below) representing 45 per cent of the total sugar cane crop being harvested in the Mackay Sugar region.

The technology allowed harvester locations to be tracked and converted to be visualised as the harvester tracks and harvested area. Combining this calculated area with information on supply throughput, it could be estimated how much cane was yet to be harvested on each farm and to calculate daily loading requirements. The same GPS tracking units were fitted to Mackay Sugar's entire cane haulage locomotive fleet and railway track maintenance vehicles.

Mackay Sugar recognised that the construction of new base stations was adding significant costs to growers wanting to adopt guidance technology.

In early 2007 Mackay Sugar approved development of six Dual Frequency 2 cm RTK base stations as outlined in Figure 27. The concept was a community network where the entry cost to farmers wishing to adopt the guidance technology would be decreased sufficiently to act as a driver for increased uptake.



Source: Sugar Research Australia <https://sugarresearch.com.au/wp-content/uploads/2017/02/Manual-Precision-Agriculture-for-the-Sugarcane-Industry.pdf>

Figure 27 Differential GPS receiver mounted on tractor and in-cab GPS guidance display



Source: Mackay Sugar <https://www.actfa.net/wp-content/uploads/2014/02/Sugar-GPS-Coordination-Applications-and-Future-Directions.pdf>

Figure 28 Mackay Sugar GPS base station network coverage map (2008)

3.5.3 Wilmar

Wilmar operate Plan Creek and Proserpine Mills and use GPS for tracking locomotives. The tracking is reliant on the 3G and 4G mobile network. Currently the cane rail network is generally well serviced with some blackspots. Voice communications is done via radio.

Wilmar also connects with GPS systems on harvesters which is used to inform Wilmar of production yields. The harvester tracking is currently reliant on the Telstra 3G mobile network which will be made redundant in 2024.

3.6 Internet of Things (IoT)

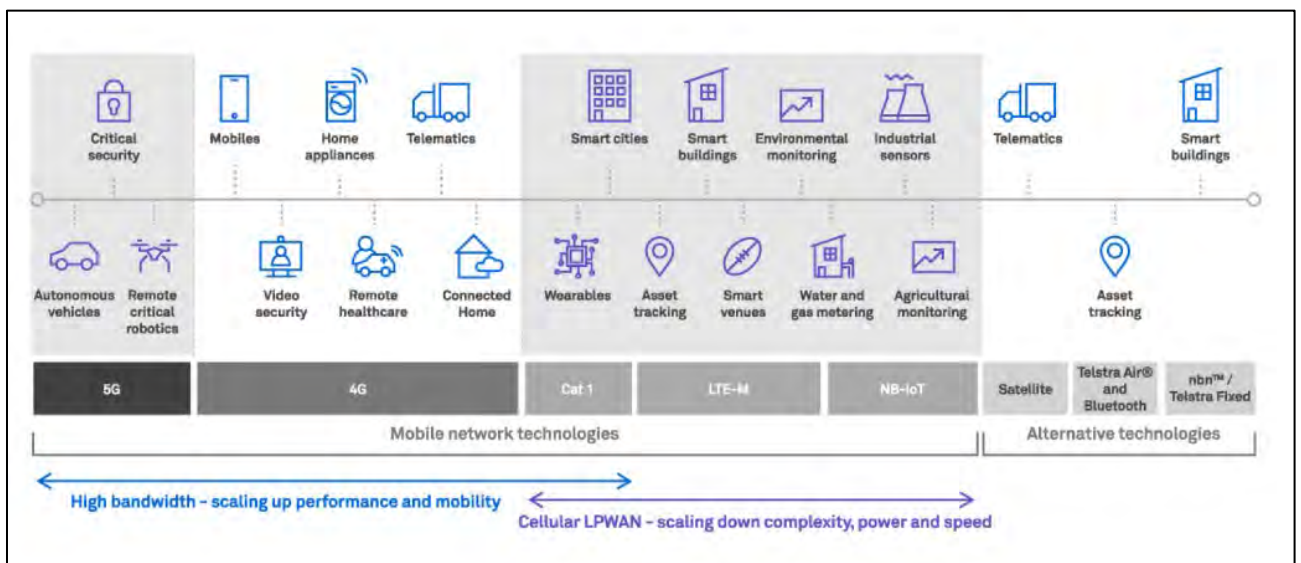
3.6.1 Overview

The Internet of Things (IoT) refers to the connection of all kinds of devices to the internet and to each other. It spans not only the wide range of smart, connected products and services now available, but also the collection of data from these devices that can be used to improve business performance.

Generally, IoT technology can connect via:

- The mobile network (3G, 4G, 5G)
- A Low Power Wide Area Network (LPWAN)
- Satellite
- Bluetooth

Figure 28 below shows examples of IoT applications and connectivity.



Source: Telstra <https://www.telstra.com.au/business-enterprise/products/internet-of-things/capabilities/iot-network>

Figure 29 IoT applications and connection examples

The majority of current market IoT solutions (or products) are connected using a combination of mobile, Wi-Fi and Bluetooth technology. These solutions are usable with smart phones and tablets and with focus on software and app development rather than physical product development.

Types of Low Power Wide Area networks (LPWAN)

Types of low power wide area networks are defined as a network that connects low-bandwidth devices over long ranges. Table 9 below summarises the key characteristics of the most common LPWANs.

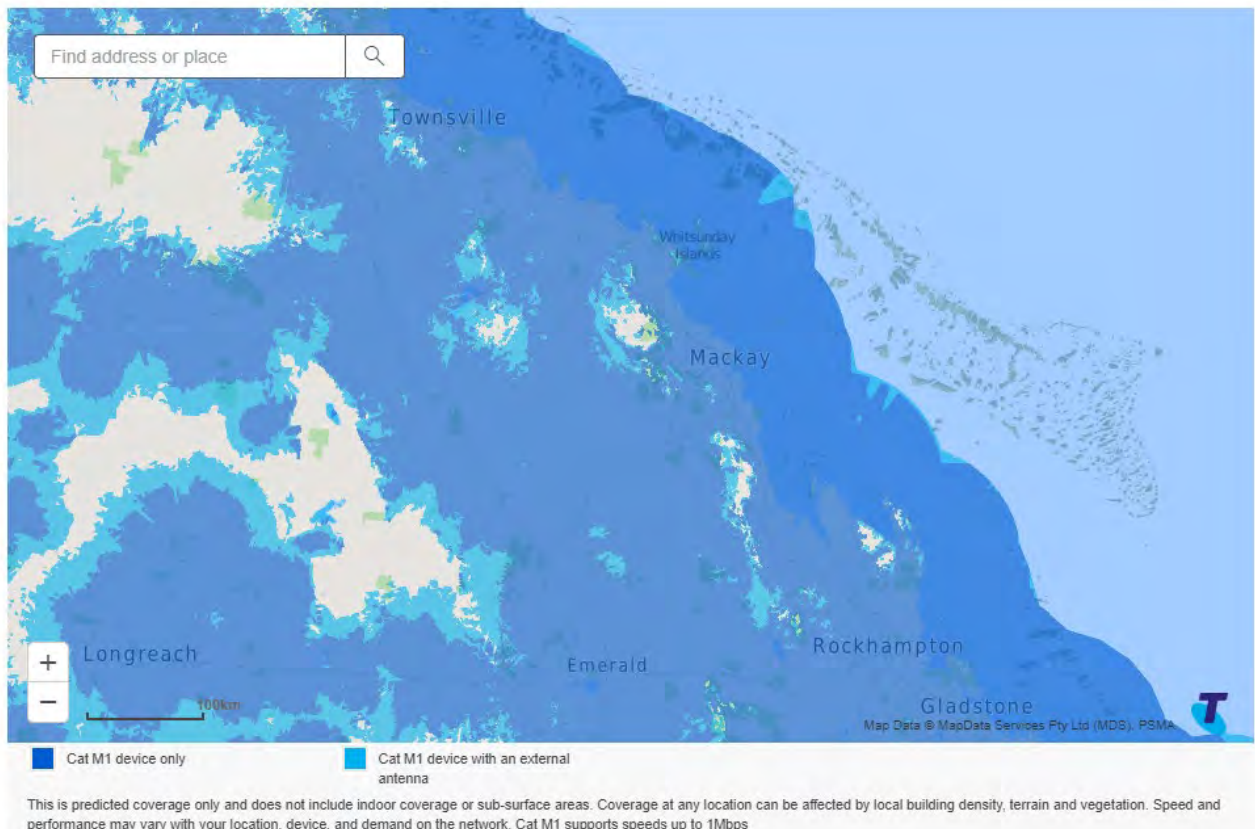
Table 9 Characteristics of types of LPWAN

	Cat-1	Long term evolution for machines LTE-M	Narrowband IoT NB-IoT	Long Range LoRa	SigFox
Specification	3GPP	3GPP	3GPP	Open	Private
Spectrum	Licensed	Licensed	Licensed	Unlicensed	Unlicensed
Device power consumption	Medium	Low	Low	Low-Medium	Low

3.6.2 LPWAN Coverage in the MIW region

LTE-M network - Telstra

Telstra provides connection for IoT applications through their Long-Term Evolution for Machines (LTE -M) (Cat M1) network. Telstra's LTE-M network is a cellular LPWAN built on the mobile network infrastructure. Figure 29 below is a coverage map of Telstra's LTE-M network in the MIW region.



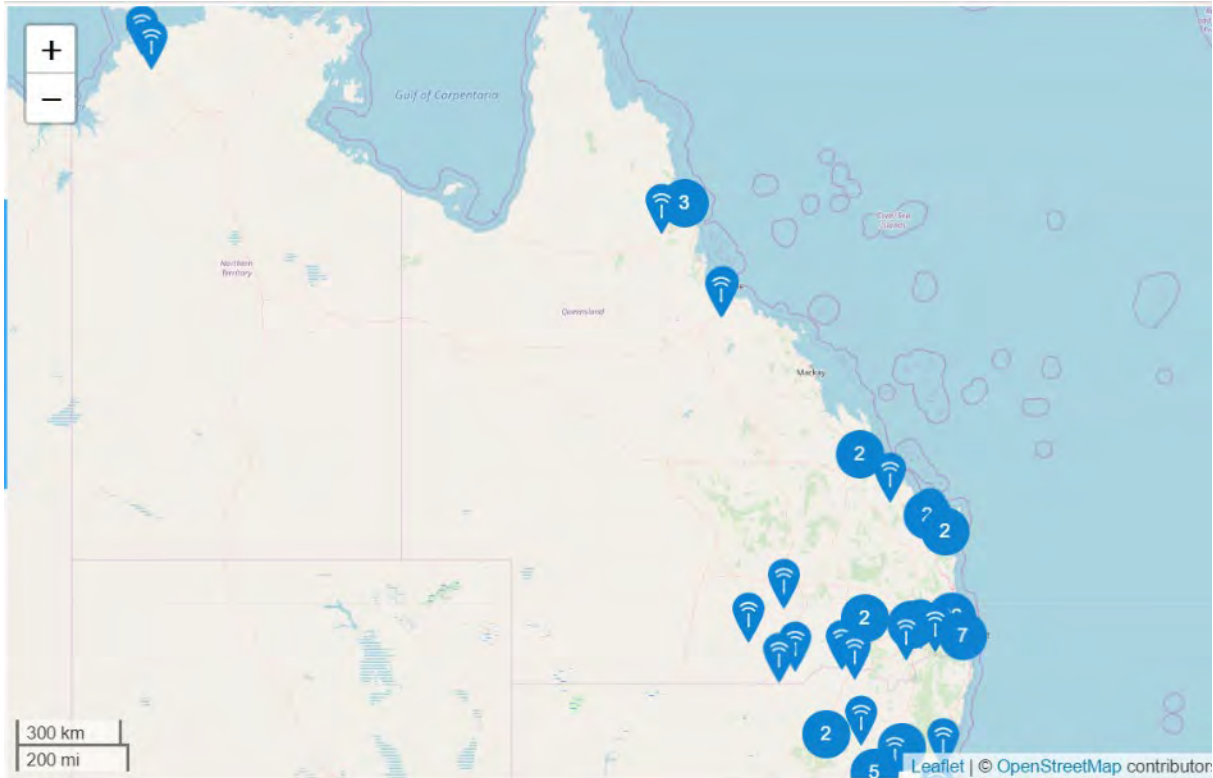
Source: Telstra <https://www.telstra.com.au/business-enterprise/solutions/internet-of-things/iot-coverage>

Figure 30 Telstra LTE-M coverage map

LoRaWAN - The Things Network

LoRaWAN is a wireless technology, developed by the LoRa Alliance. The Things Network utilises the LoRaWan alliance network to provide a set of open tools and a global, open network to build IoT applications at low cost, featuring maximum security and ready to scale.

The Things Network is now operating thousands of gateways across the world. The Things Network has a number of communities in regional Queensland shown in Figure 30. There are no communities active in the MIW region.



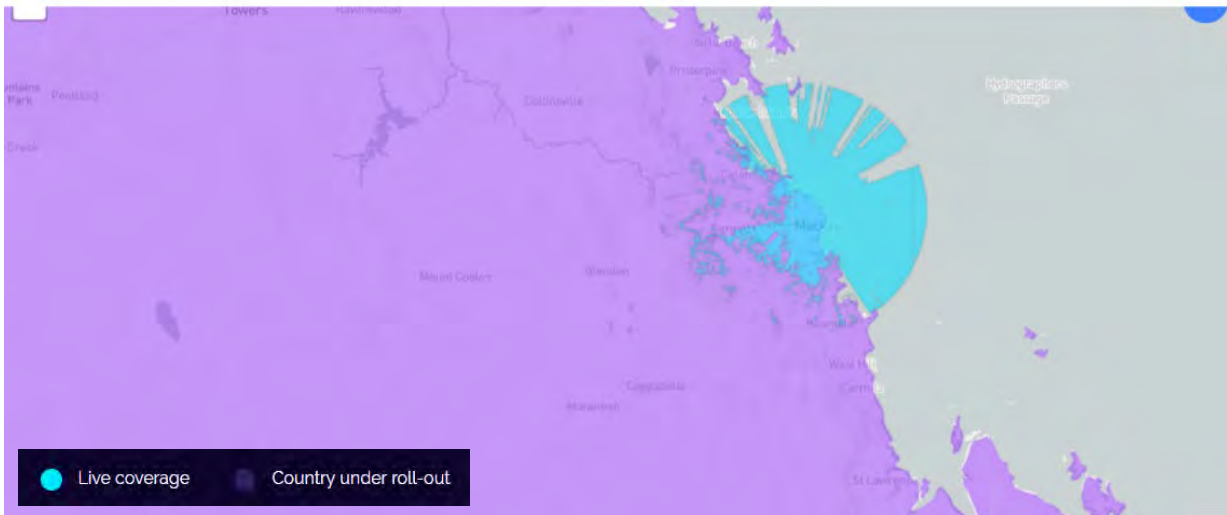
Source: The Things Network <https://www.thethingsnetwork.org/>

Figure 31 The Things Network communities in Queensland

SigFox

SigFox is a Wireless Narrowband technology, also known as Ultra Narrowband due to ultra-small payload size it supports. SigFox technology and network has been designed to meet the requirements of mass IoT applications.

The SigFox network in Australia is operated by Thinxtra. Figure 31 below illustrated the SigFox coverage in the MIW region.



Source: SigFox <https://www.sigfox.com/en/coverage>

Figure 32 SigFox coverage map

Case Study - Mackay Regional Council smart water meters

Mackay Regional Council partnered with Taggle Systems to develop a smart water network with Automatic Meter Readers (AMR) to be rolled out across the entire region to collect hourly data. Taggle Systems has developed a LPWAN to support the program.

The device transmits water meter readings periodically throughout the day and has many benefits, including the ability to detect any unusual water use patterns. The device detects the water meter dial rotating and transmits the current water meter reading as a small radio signal. Information generated is then stored in a secure database.

AMR is a progressive technology that is being utilised to greater extents throughout Australia to read both water and electricity meters. It can provide cost-effective benefits to both the service provider and the customer.



3.7 Public Wi-Fi hotspots

3.7.1 Overview

A public Wi-Fi hotspot is a physical location where people may obtain Internet access, using Wi-Fi technology, via a wireless local area network (WLAN) using a router connected to an internet service provider.

Public Wi-Fi hotspots are typically one of the following four types:

- **Free and open** - no charge to the user and no password required.
- **Free with conditions** - no charge to the user but subject to the terms and conditions of the provider.
- **Free for customers** - no charge for use of the Wi-Fi hotspot on the condition that the user has purchased a good/service from the provider.
- **Fee-for-service** - user has paid a provider to access the Wi-Fi hotspot

Public Wi-Fi hotspots provide users an alternative internet connection to mobile phone networks and give people with an internet-enabled portable device without a mobile SIM an opportunity to access the internet.

3.7.2 Council provided public Wi-Fi

All three Councils with the MIW region offer some public Wi-Fi services. These services are summarised below:

- Mackay Regional Council the city centre, at the Sarina Field of Dreams and at all library branches. Mackay Regional Council in partnership with RedFox have a 'Wi-Fi on wheels' mobile trailer which is used for events.
- Isaac Regional Council at the Clermont library
- Whitsunday at all library branches and at the Whitsunday Coast Airport

Case study - QldParks-Wi-Fi

parks.des.qld.gov.au/experiences/qldparks-wi-fi.html

The Department of Environment and Science provides free Wi-Fi across 13 sites in Queensland, none of which lie in the MIW region. The sites are mainly existing information / visitor centres and camping areas. This network has a maximum data limit of 200 mb or 4 hours of use. If this limit is exceeded, then the user will be disconnected and can reconnect after 4 hours.

3.8 Remote operating Centres (ROCs) and Remote Asset Management Centres (RAMCs)

3.8.1 Overview

Remote operation centres (ROCs) are reported to be one of the key initiatives for reducing operating and maintenance costs and increasing productivity by major resource companies in their efforts to remain globally competitive. Another consequence of ROCs is the development of Remote Asset Management Centres (RAMCs), to assist in managing skills shortages in remote areas.

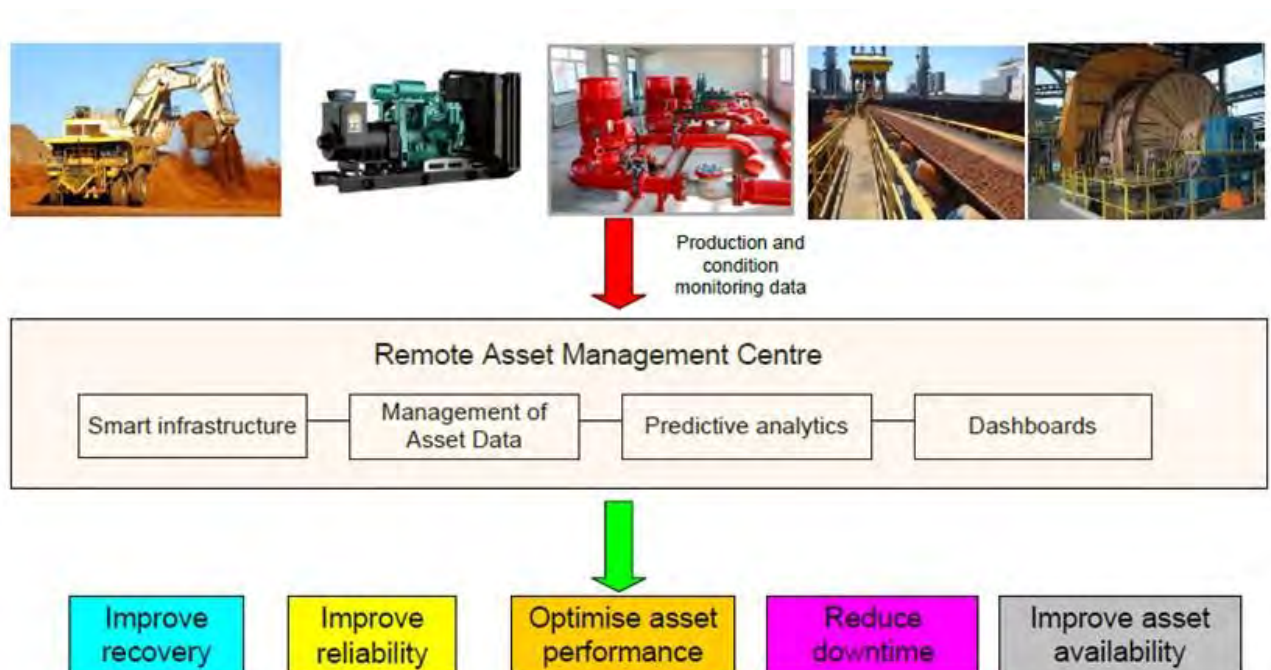
Transitioning to new technology like ROCs and RAMCs can be a challenging process for miners and contract miners. The business may have existing long-term contractors or in-house engineering teams using hand-held technology to monitor equipment in the field. The benefit of a RAMC is that a team of highly qualified engineers is always on hand to monitor sensor data and provide analysis and timely alerts without the safety risks of having people travelling in remote locations.

A recent report by IPACS on their Remote Operations Centre Stage 2 Project in South Australia provides the following summaries of the main issues relating to ROCs:

The report states ROCs should focus on delivering asset-based productivity gains and provide a suite of four core technologies as services:

- IT infrastructure management
- Physical asset data management
- Analytics
- Dashboards.

Together these services would provide real-time feedback on the performance of critical assets, wherever they are located. Figure 32 provides a summary of IPACS RAMC.



Source: IPACS 2016

Figure 33 Remote Asset Management Centre (RAMC) overview

The IPACS report discusses the structural barriers, opportunities and benefits of a RAMC. These are summarised in the following Table 10, and could also be highly relevant for service towns in the MIW region.

Table 10 Barriers, opportunities and benefits for ROCs

	Structural barriers	ROC Opportunities	ROC Benefits
Universities	<ul style="list-style-type: none"> ■ Lack of access to live data for research and teaching 	<ul style="list-style-type: none"> ■ Establishment of the IPACS ROC with live data feeds 	<ul style="list-style-type: none"> ■ Align research and training with industry needs ■ Develop innovative ROC applications for industry
Analytics and Optimization software OEMs	<ul style="list-style-type: none"> ■ Inability to sell to mid-tier miners 	<ul style="list-style-type: none"> ■ Demonstration of their technology at the IPACS ROC 	<ul style="list-style-type: none"> ■ Showcase their technology to mid-tier and contract miners and other industry sectors like defence
SMEs and Startups	<ul style="list-style-type: none"> ■ Limited exposure to mining operators and contractors ■ Inability to demonstrate their skills and technologies to target audience 	<ul style="list-style-type: none"> ■ Demonstration of their technology at the IPACS ROC ■ ROC presentations at industry events ■ ROC data provided to resource sector hackathons 	<ul style="list-style-type: none"> ■ Ability to demonstrate their technology at the IPACS ROC ■ Understand ROC benefits through participation at industry events and hackathons
Tier 1 Miners	<ul style="list-style-type: none"> ■ Limited appetite for risk from ICT innovation particularly from SMEs 	<ul style="list-style-type: none"> ■ Risk associated with new innovation will be reduced through live demonstrations at the IPACS ROC. 	<ul style="list-style-type: none"> ■ Exposure to well-designed and tested ICT innovation technologies from SMEs
Mid-tier Miners and Contract Miners	<ul style="list-style-type: none"> ■ Limited budget and appetite for risk arising from ICT projects ■ Lack of exposure to the benefits of ICT innovation ■ Inexperienced ICT staff 	<ul style="list-style-type: none"> ■ Risk will be reduced through access to the IPACS ROC. ■ The ROC will showcase innovation technology applied to live data streams. ■ The ROC will support skills development in remote monitoring and analytics. 	<ul style="list-style-type: none"> ■ Reduced risk ■ Access to ICT innovation in mining and petroleum ■ Reduced costs, improved efficiency and reliability through use of proven ICT technologies ■ Increased competitive global market position

In the future, mining operations will increasingly be driven by technological advances in sensing, autonomy, analytics, robotics and optimisation. IPACS is currently working with a broad range of companies including equipment suppliers, OEMs (original equipment manufacturers), contract miners and data analytics companies to develop customised solutions for the monitoring needs of mining companies based on the collaborative RAMC platform. Their report also provides an insight on mid-tier miners that is relevant for the MIW METS sector and mining service providers. The report states:

‘Mid-tier mining companies, their contractors and suppliers have limited budgets and appetite for risk arising from IT innovation. Remote operation technology, networked data collection and analytics based on big data principles have shown their merits in reducing costs for the Tier 1 miners who have used their extensive internal technical teams and resources to achieve these results. Unfortunately, the details and IP of these implementations are closely held by the Tier 1 organisations.

Mid-tier companies have only very limited access to such technology. The costs and associated innovation risks are too high for individual mid-tier miners. This project will provide access for the participating mid-tier

miners and contract mining companies and like-minded organizations to a demonstration of remote operations, networked data collection and analytics. The commercial collaborative ROC platform will be able to provide lower cost, lower risk access to new analytics and automation technologies.

3.8.2 ROCs in the MIW region

Currently in the Bowen Basin, BHP has been the major driver in the development of autonomous mining operations, following successful implementation in similar mining operations in Western Australia. BHP has located its Integrated Remote Operations Centre (IROC) in Brisbane, where central control of both mine and port operations is being undertaken. Other mining companies have recently had press releases announcing that they currently do not have plans for the implementation of driver-less autonomous machines, but technology is advancing in this field.

BHP has a virtual private fibre network from its Bowen Basin operations and Hay Point sites back to Brisbane that enables the IROC to operate effectively and securely. BHP have used Nexium, Aurizon Rail and fibre links from Powerlink substations to effectively create their own private NBN connection. BHP are also working on projects with Telstra and Orange Business Systems, to improve network performance further.

BHP have developed digital systems across iron ore, uranium and coal operations in a structured way to be able to deploy autonomous operations with the required levels of safety, security and functionality. A recent Deloitte report on the *Establishment of a remote operations centre* stated that these initiatives are “to drive greater productivity, efficiency, lower production costs, improved health, safety and environmental performance, and better, faster, smarter system-wide decision making, they undertook a landmark project to establish a remote integrated and centralised operations centre”.

3.9 Submarine communications cable

Submarine communication cables carry telecommunication signals between land-based stations. Modern cables are capable of carrying digital data through the use of optical fibre technology.

There is currently no direct cable link into Queensland. The Sunshine Coast Council are driving a new connection from the Japan-Guam-Australia-South (JGA-S) submarine cable landing in Maroochydore to be completed in 2020.

There are no current or planned direct cable links to the MIW region.

Case study - Sunshine Coast Council submarine cable

sunshinecoast.qld.gov.au/Council/News-Centre/Submarine-cable-announcement-070918

Sunshine Coast Council are facilitating a new cable connection from the JGA-S submarine cable to Maroochydore to be delivered in 2020.

The new 550 km undersea fibre optic cable that will connect the Sunshine Coast to the 9,600 km JGA-S cable, then further on to the Southeast Asia - United States (SEA-US) Cable System. The project will deliver Australia’s fastest telecommunications connection to Asia and second fastest to the United States.

Sunshine Coast Council are funding the project, which RTI with consortium partners Google and the Australian Academic Research Network are constructing. The Queensland Government is providing funding support with a \$15 million grant.

The new connection will allow Queensland businesses to bypass Sydney and have direct connections internationally, bring increased speed, diversity and the associated business opportunities provided by these benefits. It will also flag the region as a priority for investment by major data-intensive companies such as Facebook, Google, Amazon and Microsoft.

4 Strategic digital infrastructure planning

4.1 Overview

Strategic digital infrastructure planning is required to be undertaken at all levels of government, across private enterprises and with hardware and software technology providers. In order for consumers and businesses to achieve increases in productivity, advances in e-connectivity are required that work for all members of the value chain.

In today's information-driven global economy, e-connectivity is not simply an amenity - it has become essential. E-connectivity, or electronic connectivity, is more than just connecting households, schools, and healthcare centres to each other, as well as to the rest of the world, through high-speed internet. It is also a tool that enables increased productivity for farms, factories, forests, mining, and small businesses. E-connectivity is fundamental for economic development, innovation, advancements in technology, workforce readiness, and an improved quality of life.

Telecommunications infrastructure is viewed as 'user pays' infrastructure rather than infrastructure that is subsidised or funded by the government (refer to Figure 33 below). Government funding of telecommunications infrastructure, particularly for new development, is not regular practice in Australia.



Source: Better Cities Program 1993

Figure 34 User subsidy and user pays scale

4.2 Commonwealth government

4.2.1 Key agencies

The key Commonwealth agencies that are involved with digital infrastructure planning are:

- **Australian Communications and Media Authority** - an independent statutory authority tasked with ensuring most elements of Australia's media and communications legislation, related regulations, and numerous derived standards and codes of practice operate effectively and efficiently, and in the public interest.
- **Australian Competition and Consumer Commission** - an independent Commonwealth statutory authority responsible for the economic regulation of the communications sector, including telecommunications and the NBN, broadcasting and content sectors.
- **Department of Infrastructure, Transport, Regional Development and Communications** - the Department is responsible for the communications sector and the Department's portfolio includes the Smart Cities Plan and the City and Regional Deal initiative.
- **Department of Industry, Science, Energy and Resources** - the Department's portfolio includes the digital economy and technology.
- **Geoscience Australia** - the national public sector geoscience organisation. One of Geoscience Australia's strategic priorities is creating a location-enabled Australia.
- **National Broadband Network (NBN Co)** - NBN Co was established in 2009 and is wholly owned by the Commonwealth Government as a Government Business Enterprise.

4.2.2 Key initiatives

Universal Service Guarantee (USG) for telecommunications

In December 2017, the then Department of Communications and the Arts announced a program of work to develop a Universal Service Guarantee (USG) that would ensure all Australian premises, irrespective of location, have access to voice and broadband services. Under this model, USG services would generally be delivered on a commercial basis, leveraging the Commonwealth's investment in the NBN and other commercial networks.

The Universal Service Guarantee (USG) updates the long-standing Universal Service Obligation (USO) to ensure all Australians have access to voice and broadband services.

The USG will utilise NBN to deliver broadband service and will continue to use Telstra's existing copper and wireless networks in rural and remote area for the provision of voice services in NBN fixed wireless and satellite areas.

Mobile Black Spot Program

The MBSP is administered by the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications, and awards funding (up to 50 per cent of initial costs) to successful national Mobile Network Operator (MNO) or a Mobile Network Infrastructure Provider (MNIP). The Government's has committed \$380 million over six rounds which has delivered 867 new base stations across Australia.

Refer to Section 3.3.2 Mobile network coverage in the MIW region for an overview the funded locations within the MIW region.

Telecommunications Reform Package

On 22 June 2017 the Government introduced the *Telecommunications Legislation Amendment (Competition and Consumer) Bill 2017* (the Bill) to Parliament.

The Bill establishes the Regional Broadband Scheme levy for fixed wireless and satellite infrastructure by imposing a monthly charge on carriers in relation to each premises connected to their network that has an active fixed-line superfast broadband service during the month.

2018 Regional Telecommunications Review

The Regional Telecommunications Independent Review Committee reviews telecommunications services in regional, rural and remote parts of Australia every three years. The key disadvantages in the rural and remote communities identified were:

- Sky Muster satellite service data limitations,
- Congestion on the fixed wireless network
- Poor mobile coverage.

The committee delivered 10 recommendations covering access to infrastructure, consumer protection and digital inclusion.

In response to the review recommendations the following initiatives have been announced:

- **Regional Connectivity Program** - the Department of Infrastructure, Transport, Regional Development and Communications' Regional Connectivity Program will provide place-based solutions to regional digital connectivity issues through a range of mobile and/or broadband services and will complement the NBN, the Mobile Black Spot Program and the telecommunications industry's commercial investment plans.
- **NBN Co** - NBN Co has established a dedicated unit focused on delivering NBN benefits for regional Australians and has launched a new wholesale Business Satellite Service which will deliver business-grade broadband to medium and large enterprises in eligible rural and remote areas.

Positioning Australia program

In the 2018-19 Federal Budget the Australian Government announced an investment of \$224.9 million to enable precise positioning for Australia. The purpose of the program is to deliver a national capability that accelerates the adoption and development of location-based technology and applications. The program includes:

- The National Positioning Infrastructure Capability - a national network of ground station infrastructure.
- A system to deliver corrected positioning signals directly to you via satellite technology through an Australian Satellite-Based Augmentation System (SBAS). This uses a set of ground-based stations that track GPS signals and computes a set of corrections to offset the atmospheric errors GPS can face.

Current technology typically allows for positioning within 5-10 m accuracy, but through this program, accuracy will be improved to within 3 cm in areas with mobile phone coverage and 10 cm everywhere else.

Case study – SBAS Vehicle Positioning at Middlemount Coal

ga.gov.au/scientific-topics/positioning-navigation/positioning-australia/industry-users/mining

SBAS receivers were fitted onto fleet vehicles at a Middlemount coal mine as part of a trial. These receivers could be used to determine proximity to both personnel and other vehicles. By integrating this technology with the existing Safety Fleet Management System, safety could be vastly improved by allowing mobile fleets to operate with greater confidence. Other safety advantages through this technology include improved collision avoidance systems, remote monitoring of vehicles and the implementation of exclusion zones to inform operators of high-risk environments.

Case study – CQUni Satellite Livestock Tracking

cqu.edu.au/cquninews/stories/research-category/2017/cquni-among-first-to-join-trial-of-new-satellite-positioning-technology

Central Queensland University lead a project in 2017 which aimed to use SBAS to lower costs and boost yields for cattle and sheep farmers. Three new technologies were trialed as part of the project, with \$12m in funding from the Australian Government and a further \$2m from the New Zealand Government.

The project was driven by improved satellite positioning technology, which has seen achievable positional accuracies reduced from 5-10m to less than 10cm. One of the trials was the precise tracking of livestock via smart ear tags. This could be used for early disease detection and more efficient breeding programs by allowing remote monitoring of the livestock behaviour. Further to this, another proposed product of the technology is 'virtual fencing' whereby sound-emitting collars worn by the livestock could track their position and deter them from travelling outside a pre-defined boundary. This would reduce fencing labour and costs and could control over-grazing in vegetation-scarce areas.

Smart Cities

The Smart Cities Plan is Australian Government's vision for our cities, and our plan for maximising their potential based on three pillars. These pillars include:

- Smart Investment
- Smart Policy
- Smart Technology

Case study - Switching on Darwin

www.infrastructure.gov.au/cities/smart-cities/collaboration-platform/Switching-on-Darwin.aspx

Switching on Darwin is a significant project driving smart solutions for the City of Darwin. The project was jointly funded by the Commonwealth, Territory and local governments.

The project will deliver a range of smart technologies including:

- Upgrading 912 CBD street lights to LED smart lighting
- Extension of free Wi-Fi network
- 138 CCTV cameras in CBD
- Sensors for vehicle and pedestrian movement analysis
- Smart parking technology
- Microclimate monitoring systems
- A smart city platform

Case study - Yeppoon Town Centre Smart Precinct project

www.infrastructure.gov.au/cities/smart-cities/collaboration-platform/Yeppoon-Town-Centre-Smart-Precinct-Project.aspx

Livingston Shire Council received a grant from the Australian Government Smart Cities and Suburbs initiative. The Yeppoon Town Centre Smart Precinct project included smart LED street lighting, access to free Wi-Fi, a LORAWAN network (long-range wireless communication protocol), bin sensors, interactive digital placemaking features.

City and Regional Deals

City Deals are a mechanism under the Smart Cities Plan and are a partnership between the three levels of government. City Deals work towards a shared vision for productive and liveable cities. They seek to align planning, investment and governance to result in growth, and job creation, stimulate urban renewal and drive economic reform. As of November 2019, seven city deals have been agreed to date. These include:

- Adelaide, South Australia
- Darwin, Northern Territory
- Geelong, Victoria
- Hobart, Tasmania
- Launceston, Tasmania,
- Townsville, Queensland
- Western Sydney, New South Wales

Similar to the City Deals, the Regional deals brings together all three levels of government with a clear set of objectives. The deals are tailored to each region's assets and challenges, comparative advantages and reflect the unique needs of that area.

These deals are focused at putting the community-identified priorities at the centre. The Barkly Regional Deal, covering the Tennant Creek region in the Northern Territory, is the first regional deal in Australia. Regional Deals for Hinkler (covering the Bundaberg and Hervey Bay region) and Albury Wodonga is underway.

4.3 Queensland State government

4.3.1 Key agencies

The key Queensland State government agencies that are involved with digital infrastructure planning are:

- **Department of Housing and Public Works** - the Department's portfolio includes digital technology and services include the Mobile Black Spot Program.
- **Department of Innovation and Tourism Industry Development** - the Department's portfolio includes Advance Queensland and QCN Fibre.
- **Department of State Development, Manufacturing, Infrastructure and Planning** - the Department is responsible for the State Infrastructure Plan.

4.3.2 Key initiatives

QCN Fibre

QCN Fibre, previously known as FibreCo Queensland, is a State-owned entity owned by Powerlink Queensland and Energy Queensland established in 2019. QCN Fibre will utilise spare capacity on the government-owned optical fibre network to sell backhaul services to telecommunications companies such as Retail Service Providers and Internet Service Providers.

State Infrastructure Plan

The Queensland Government is committed to provide secure, reliable and cost-effective digital infrastructure to improve the lives of Queenslanders by connecting regions, communities and businesses to better services and the digital economy.

The *State Infrastructure Plan* lists the following outcomes for digital infrastructure

- By 2031, all Queenslanders have fast connectivity to the internet.
- By 2031, every Queensland city and town with a population of 2000 or more will not experience any mobile blackspots.
- Queensland is recognised globally for its world-class digitally-enabled health care.
- Queensland will lead Australia in digital government services.
- By 2031, the Queensland Government leads the nation in the use of open data and data science to fully leverage infrastructure investments.

The 2019 update of the State Infrastructure Plan lists the following initiatives:

- Establishing QCN Fibre (formerly known as FibreCo Qld)
- The Public Safety Regional Radio Communication project for the Queensland Fire and Emergency Service
- TAFE Queensland - one network and Wi-Fi upgrade
- Regional Internet of Things (RIoT) Program.

As part of the State Infrastructure Plan, the Queensland Department of Public Works and Housing have prepared a State Digital Infrastructure Plan. The Department has confirmed the plan is currently on hold and not a public document.

Building our Regions program

The Department of State Development, Manufacturing, Infrastructure and Planning administers the Building our Regions program. The program is aimed to support local government infrastructure projects in regional communities.

The program is funded by Regional Capital Fund, which Mackay LGA is eligible, and the Royalties for Resource Producing Communities Fund, which Isaac and Whitsunday LGAs are eligible.

The program is focused on improving economic outcomes for regions

Remote and Aboriginal and Torres Strait Islander Communities Fund

A series of digital infrastructure projects, including the Balonne Shire Council and Bulloo Shire Council Digital Connectivity Project, received a \$1 million funding to deliver high-speed internet through the construction of telecommunication towers and other digital communication infrastructure to enable access to reliable internet access.

4.4 Local government

Local government's role in telecommunications planning includes:

- regulating new development and infrastructure,
- asset owner of digital infrastructure including LPWAN networks and fibre optic networks, and
- developing regional based digital infrastructure strategies.

4.5 Carriers

The Mobile Phone Base Station Deployment Industry Code (C564:2018) was developed by the Communications Alliance Ltd to provide greater transparency to local community and councils when a Carrier is planning, selecting sites for mobile base stations.

One of the general obligations the Industry Code set out for carriers is the provision of information to Council with the following examples

- Providing the Council with the Carrier's forward project plans
- Engaging with other Carriers to explore opportunities for co-location and to investigate opportunities for the coordinated, strategic and efficient deployment of infrastructure
- Providing the Council with an assessment of the opportunities for co-location with other Carriers
- Providing the Council with as much forward planning notice as possible.

The Mobile Carrier Forum has published a Precautionary Approach to Site Selection procedure. Carriers must take into consideration:

- EME exposure to the public
- Proximity to community sensitive locations
- The built, cultural and natural heritage significance of the site
- Relevant state and local government telecommunications planning policies
- The outcomes of consultation processes with Councils and Interested and Affected Parties
- The availability of land and public utilities
- The connection with the rest of the network
- Potential radiofrequency interference
- Co-location opportunities
- Cost factors.

In general, carriers prefer to locate greenfield sites on existing infrastructure, ie rooftops and elevated water towers, and in industrial and commercial areas setback from sensitive land uses.

4.6 Regional benchmarks

4.6.1 Regional Queensland

To gauge the MIW region against other regional centres in Queensland, a summary of the current digital infrastructure policies and projects was completed for Cairns, Townsville, Rockhampton, Bundaberg and Toowoomba.

Table 11 Summary of digital infrastructure in regional Queensland centres

	Cairns	Townsville	Rockhampton	Bundaberg	Toowoomba
Council published digital strategy	No	Yes	Yes	Yes	Yes
Mobile network	Telstra 5G coverage	Telstra 5G coverage	Telstra 5G coverage	Telstra 5G coverage	Telstra 5G coverage
Internet of Things network	Council IoT network The Things Network community	The Things Network community	The Things Network community	The Things Network community	The Things Network community
Public Wi-Fi	Widespread in the urban areas under a Council arrangement with Telstra Air	MiTowns ville Wi-Fi available at Council facilities	Available in the Rockhampton city centre and airport	Available at Council facilities and Bundaberg city centre	Widespread in the urban areas under a Council arrangement with Telstra Air

Cairns

Cairns Regional Council does not have a specific digital infrastructure strategy. FNQROC commissioned a mobile coverage audit along heavy vehicle and tourism routes which found 70% of the routes were in a blackspot. FNQROC are planning to complete a mobile communication strategic prioritisation strategy.

Telstra's 5G network is switched on in some patches of the Cairns urban area plus Gordonvale.

Cairns Regional Council provides free public Wi-Fi through an agreement with Telstra Air and has deployed several IoT technology-based projects including:

- a drive-by car parking enforcement solution and
- a smart urban irrigation project with funding received through the Commonwealth government's Smart Cities and Suburbs program.

Townsville

Townsville City Council has developed a smart city strategy - *Smart Townsville*, as part of the Townsville City Deal.

Telstra's 5G network is switched on in some patches of the Townsville urban area.

The *Smart Townsville* initiative has delivered a number digital infrastructure projects including:

- A publicly accessible IoT network
- The 'MiTownsville' Wi-Fi that is available in Council libraries, facilities and parks
- The North Queensland Regional Data Centre which will be operated by Council and available to businesses.

Rockhampton

Rockhampton Regional Council launched their Smart Regional Centre Strategy in December 2015. One of the key component of the strategy is enabling digital infrastructure with the following initiatives:

- Broadband and mobile connectivity - discussions with NBN Co. and telecommunications carriers and will further investigate options on how Council's resources can assist in implementing this infrastructure.

- Establishment a not-for-profit community Internet Services Provider (ISP)
- Wi-Fi
 - Installation of free Wi-Fi as part of the completed riverfront redevelopment
 - Expansion of the eduRoam Wi-Fi in partnership with CQUni.
- iBeacons
 - Installation of iBeacons within the CBD Core to allow Council, retailers and businesses to develop and use promotion and information applications.
- Sensors
 - Installation of traffic, carparking and water sensors.

Livingstone Shire Council has developed a Capricorn Coast Smart Region Strategy which includes the provision for smart infrastructure.

Telstra's 5G network is switched on in some patches of the Rockhampton urban area.

Bundaberg

Bundaberg Regional have developed an Intelligent Community Strategy. The strategy includes the rollout of the free public Wi-Fi, a publicly accessible LoRaWAN IoT network and a Smart Water Meter pilot.

The Wide Bay ROC identifies telecommunications blackspots as a regional priority.

Telstra's 5G network is switched on in some patches of the Bundaberg urban area.

Toowoomba

Toowoomba Regional Council developed a Digital Economy Strategy in 2015.

Toowoomba has a number of digital infrastructure hubs including the Toowoomba Technology Park which hosts the Pulse Data Centre.

Telstra's 5G network is switched on in the Toowoomba city centre.

5 Digital infrastructure trends

5.1 Global trends

5.1.1 Overview

The global internet use in a snapshot:

- More than 360 million people gained connection to the internet for the first time in 2018 (nearly 1 million new users per day)
- 57 per cent of the world's population (4.39 billion people) are now connected to the internet as at January 2019; an increase of 9.1 per cent since the start of 2018.
- 91 per cent (approximately 3.99 billion people) make use of a mobile internet connection.
- The average user spends about 6.75 hrs on the internet each day; of this internet usage, the average person spends about 3.25 hrs using mobile internet each day; a 4.3 per cent increase from 2018.
- The global average fixed internet download speed is 54.33 Mbps, a 33 per cent improvement since 2018. There is a global average of 25.08 Mbps is seen for mobile internet.

For fixed internet, the top 3 countries for download speed were

- Singapore - 190.9 Mbps
- Hong Kong - 161.39 Mbps
- South Korea - 119.6 Mbps

For mobile internet, the top three countries for download speed were

- Canada - 63.1 Mbps
- Singapore - 61.0 Mbps
- Australia - 56.5 Mbps

5.1.2 Data Reliance

Day-to-day business operations are increasingly being driven by data acquisition, screening, analysis, interpretation and application.

CSIRO's Data61 describes the concept of a "data-driven organisation" in their 2019 issue of the Digital Megatrends report. This is an organisation that is adept in all aspects of data handling, from capture through to using it to make short and long term decisions. With consideration of current trends, all organisations are on a pathway to being data driven.

In 2017, Australia's fibre connections doubled to nearly 3 million – this coincided with a doubling of data consumption (1.7 million terabytes to 3.5 million terabytes). This has largely been attributed to increased use of media streaming services. To accommodate this, it is expected there will be 628 data centres worldwide by 2021, handling just over half of the world's traffic.

As an example of how this data reliance could influence infrastructure needs, IT giants such as Cisco and Huawei are driving the concept of 'Smart Cities'. These are cities where a series of cameras, sensors and IoT objects would be gathering information, controlled by an Intelligent Operations Centre. Large-scale, forward-thinking projects such as these are not just held back by technological/infrastructure availability, but also social, political and privacy-related concerns.

Future opportunities for data centres in the MIW region may be created if some of the integrated remote operations centre (IROC) were to be located in either Moranbah or Mackay.

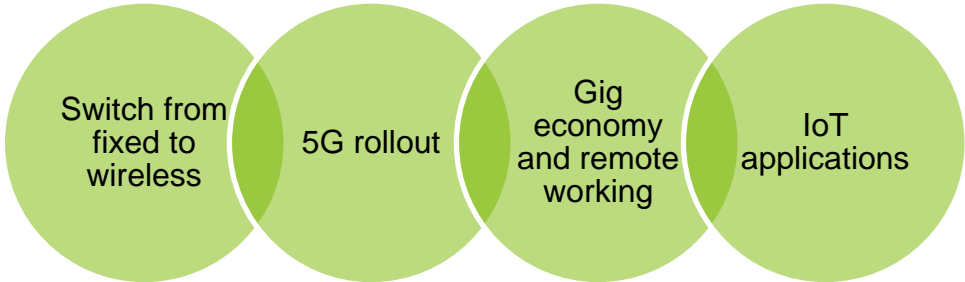
5.2 National trends

5.2.1 Overview

Data collected by the ABS in the 2017-8 Business Characteristics Survey documents the trends in digital infrastructure use by industry and employment size.

- 18.5 per cent of respondents in the agriculture, forestry and fishing industry noted a lack of access to digital infrastructure which is the largest business representation in the MIW region.
- 69.5 per cent of respondents in the construction industry and 65.8 per cent of the rental, hiring and real estate industry cited mobile internet of being a major importance. This is likely due to the mobile nature of these industries.
- Access to high speed internet is of major importance to 50.4 per cent of all respondents including 71.1 per cent of information media and telecommunications and 68.1 per cent of the financial and insurance services.
- 79.4 per cent of business with 200 or more employees cited as access to high speed internet is of major importance as compared to 46.7 per cent of business within 4 or less employees.

The four main trends impacting on digital infrastructure in Australia are:



5.2.2 Switch from fixed to wireless

The advancement in smart phones and an increasing number of business applications being optimised for mobile devices along with the decreasing price of mobile data has prompted a switch from businesses relying on fixed line access to wireless.

The Internet Activity Report produced by the ACCC reported that 51 per cent of internet access connections in Australia were via mobile wireless. The Wireless Telecommunications Carriers in Australia report published by IBIS World in January 2019 stated mobile data usage is anticipated to continue replacing voice calls, SMS and MMS as smartphone apps, video streaming and social networking that improve on traditional mobile functionalities are further developed.

5.2.3 5G

The mobile network technologies are categorised into generations - 1G, 2G, 3G, 4G and 5G.

The 3G and 4G network are currently operational within Australia and 5G is emerging. The 3G network is expected to be made redundant in the next 5 years with Telstra announcing the network will be turned off in mid-2024.

The 5G technology is classified by:

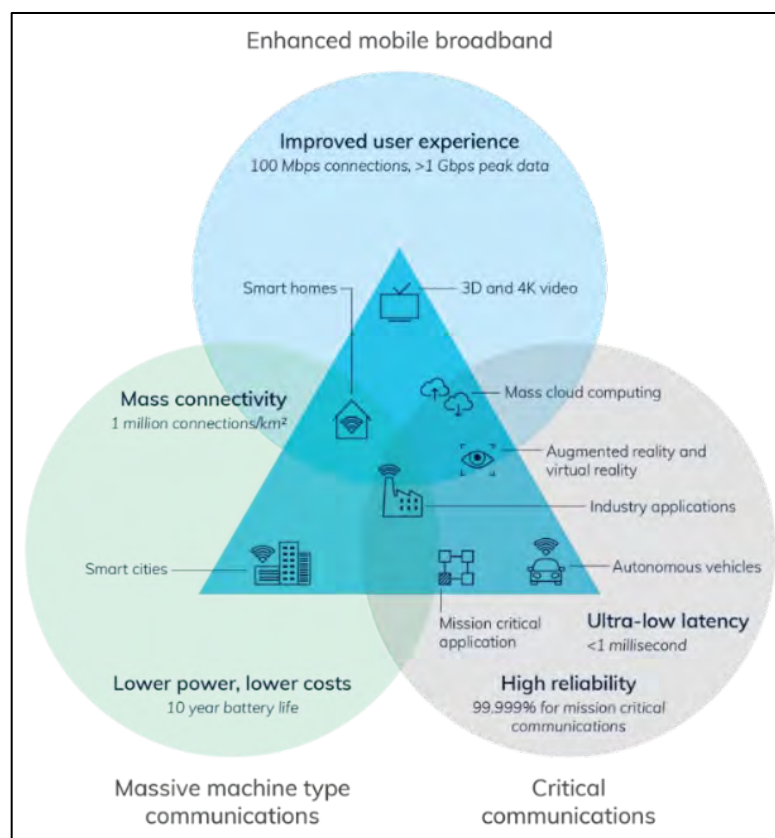
- **Data rates** — data rates of 1–10 Gbps, which is a step change for mobile networks and is expected to facilitate a high quality and a more seamless user experience. By comparison, 4G networks in Australia provide advertised data rates of between 2–100 Mbps.

- **Ultra-low latency** — reduce latency to a one millisecond end-to-end round-trip delay. This is also a step change for mobile networks. By comparison, 4G networks can theoretically achieve a minimum latency of 10 m/s.
- **Bandwidth** — provide 1000 times more bandwidth per unit area than available on existing mobile networks. This will support faster data rates and increase network capacity to support data intensive applications in both the uplink and downlink.
- **Connections** — support the growth of between 10 to 100 times more connected devices than is now supported by existing networks. This is also theoretically possible on evolving 4G networks and mass connectivity is identified as a key enabler for the IoT.
- **Always on** — be available everywhere (100 per cent coverage) at all times (99.999 per cent of the time). This requirement is also theoretically achievable using evolving 4G technologies. It is necessary for high mobility applications and coverage indoors and outdoors as well as high reliability requirements for services where network outage could have catastrophic consequences.
- **Energy usage** — reduce network energy usage by 90 per cent.
- **Battery life** — facilitate up to 10 years battery life for low power, machine-type devices. Both the energy usage and battery life requirements are theoretically achievable using evolving 4G technologies.

The *5G – enabling the future economy* paper published in 2017 details the Commonwealth Government's direction to prepare the rollout of 5G in Australia. Key actions items identified were:

- Making spectrum available in a timely manner
- Actively engaging in international spectrum harmonisation activities
- Streamlining arrangements to allow mobile carriers to deploy infrastructure more quickly
- Review existing telecommunications regulatory arrangements to ensure they are fit-for-purpose

Figure 34 illustrates the expected service and applications from 5G technology.



Source: <https://www.communications.gov.au/departmental-news/5g-enabling-future-economy>

Figure 35 Expected 5G services and applications

The 5G network uses small cell infrastructure which means 5G will use a higher number of smaller base stations known as small cells, instead of large, geographically dispersed mobile base stations. These cells have a coverage range of 50 - 200 m depending on the environment.

The following summarises the 5G rollout of the three carriers:

■ **Telstra:**

- As of November 2019, Telstra has rolled out 5G coverage in 10 areas in Queensland including Cairns, Townsville, Rockhampton and Bundaberg in regional Queensland.
- Coverage is mainly limited to CBD areas and airports during the initial rollout, but Telstra anticipates this will cover up to 4 million Australians to some degree.

■ **Optus:**

- Optus has started to rollout their 5G network which is now available in selected areas in Brisbane, Queensland.
- Optus have indicated that a 5G rollout in regional Queensland is not likely in the next 3 years.

■ **Vodafone:**

- Won't see the widespread availability of 5G devices until 2020.
- Ban on infrastructure partner Huawei in Australia has created a roadblock to an eventual upgrade to 5G – currently awaiting on approval for merger with TPG which would fast-track 5G rollout.

5.2.4 Gig economy and remote working

Gig economy

The gig economy is a labour market characterised by short-term contracts or freelance work as opposed to permanent jobs. The gig economy supports the practice of on-demand work.

Jobs Queensland's social research project looked at alternative work arrangements in Queensland. From 1999 to 2019 the number of Queensland's in full-time position dropped from 75 per cent to 69 per cent. Part-time employment has increased with flexible and remote work a growing trend.

Common digital platforms used in the gig economy include:

- Ride sharing services for a fare - Uber, Taxify
- Delivery services for a fee - Deliveroo, Uber Eats
- Personal services, including creative or professional services - Airtasker, Expert360, Freelancer, Sidekicker.

Generally, uptake for these platforms is slower in the regional centres; Uber was rolled out in Mackay in 2018 and Uber Eats in 2019.

Remote working

Many organisations in various industries are dependent on employees driving their own productivity in order to deliver quality service to clients at a high quantity. For example, a 2018 survey of 1003 randomly selected employees (conducted by Censuswide) showed:

- 68 per cent of Australian employers indicate their company allows employees to work remotely, away from the designated office space.
- 49 per cent of employees think working remotely makes them more productive.

With technology advancements, functions such as videoconferencing and cloud services have meant that employees do not need to be in the same room as their colleagues, or be connected to the same network as

them, to be able to collaborate effectively. With network performance increasing and more places accessing high-speed connections, this lifestyle is expected to become increasingly well supported.

Co-op work centres are becoming a key piece of infrastructure for the general public, professionals and students. These centres can take the form of public libraries, cafés, and public hotspots.

The concept of an innovation hub is also gaining traction with support by both the government and the general public. \$755 million in grants has been offered by the Queensland Government for digital infrastructure and technology as part of the Advance Queensland strategy.

Case study - The Precinct

<https://advance.qld.gov.au/precinct>

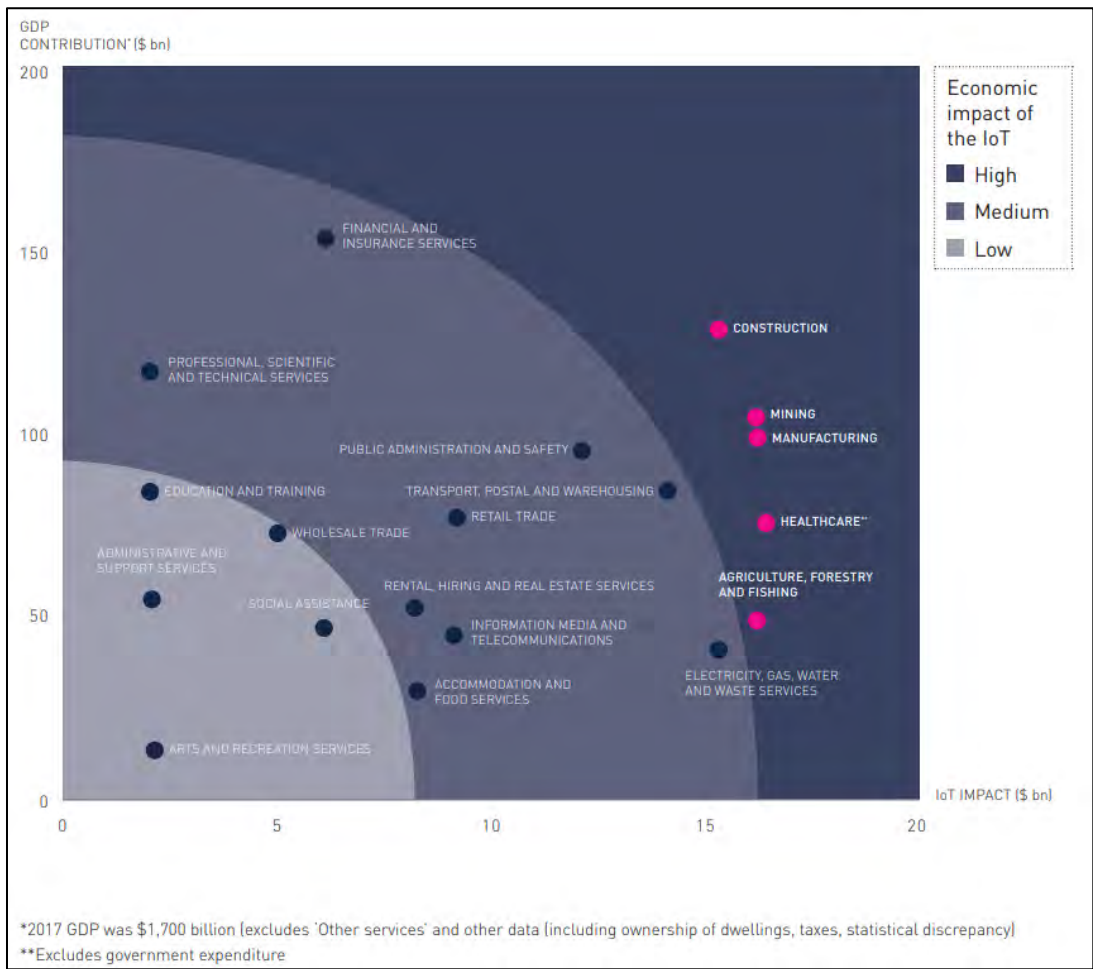
The Precinct is an innovation hub in Fortitude Valley, Brisbane delivered through the Advance Queensland strategy. This three-storey facility comprises of collaboration, office, meeting and events spaces and is intended as a co-working space for emerging entrepreneurs and start-ups. CSIRO's Data61 is a key foundation tenant.

5.2.5 IoT applications

In 2019, the Australian Computer Society commissioned a report from PricewaterhouseCoopers (PwC) into Australia's opportunities in IoT.

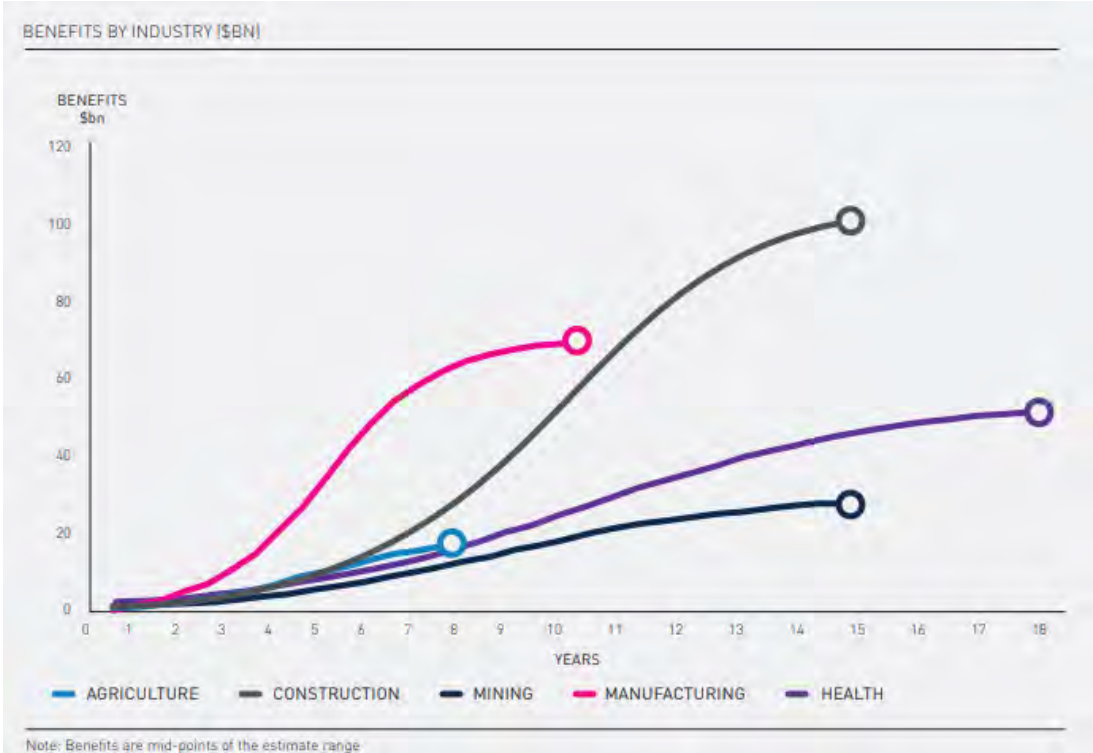
The report estimated AUD\$ 5-6 Trillion in economic benefit is expected to be delivered by IoT globally by 2023. Additionally, through 2020, industrial companies are forecast to invest \$907 billion each year to their IoT initiatives.

Industries such as construction, mining and manufacturing, that deliver value through the significant use of physical assets came out as high-impact industries regarding how they will be influenced by the emergence of IoT. The following figures highlight the projected financial benefits that key Australian industries may experience if IoT is implemented strategically.



Source: PwC 2018

Figure 36 Australian industries mapped according to IoT financial impact



Source: PwC 2018

Figure 37 Estimated ranges of IoT financial benefit for key Australian industries

Table 12 below breaks down each of the key industries highlighted in Figure 35 and Figure 36 in terms of identifying trends that can catalyse the growth of IoT and providing some examples of IoT implementations that could be or already are being applied.

Table 12 IoT trends and examples

Industry	Current trends / observations	Examples
Agriculture	<p>IoT solutions are well positioned to drive a step change in productivity, as farming in Australia is still largely manual and has not changed significantly over time.</p> <p>Next generation of farmers moving into decision-making positions. The next generation is technologically savvy and more open to innovation and change.</p>	<p>The health and location of livestock can be monitored remotely and continuously.</p> <p>Autonomous vehicles will improve farm productivity.</p> <p>Descriptors and sensors monitor the environment (e.g. temperature, water levels).</p> <p>Systems such as irrigation and feed stations can respond automatically when certain thresholds are reached.</p>
Construction	<p>Construction is traditionally slow to adopt process innovation.</p> <p>Increased take-up of Building Information Modelling (BIM) systems.</p> <p>Use of sensors for health and safety and labour tracking.</p>	<p>Autonomous construction equipment.</p> <p>Robots for undertaking repetitive tasks such as bricklaying.</p> <p>Possible integration with Building Information Modelling (BIM) systems (eg vibration sensors to identify defects).</p>
Healthcare	<p>Smart Hospitals which have interconnected IoT systems.</p> <p>“Smart Care” IoT in the primary and secondary health care sector including wearables to allow remote monitoring.</p>	<p>Sensors providing real-time inventory and monitoring of patient vitals.</p> <p>Patient movement tracking.</p>
Manufacturing	<p>Manufacturing is a stable and controlled setting and typically operate by combining many ‘things’ (machines and sensors) creating the ideal environment for the IoT.</p> <p>Manufacturing is the most advanced industry of IoT take-up.</p> <p>Recent start-up activity leveraging more advanced and agile technology, for example around the declining automotive industry in South Australia, demonstrates promising improvements (Industry 4.0).</p> <p>With most of Australia's manufacturing sector somewhat less complex, benefits in some areas may not be as significant as could be expected in some other developed markets.</p>	<p>Autonomous vehicles will enable the movement of goods around the factory.</p> <p>Autonomously recognising humans in the vicinity of operational equipment for safety.</p> <p>AI can enable remote maintenance of machinery to reduce downtime.</p>
Mining	<p>Activities are repeatable (e.g. transport, excavation, moving materials) and not dissimilar from mine to mine. These characteristics make mining a fertile ground for impactful IoT solutions.</p> <p>Recent decline in productivity and uncertainty about commodity price growth.</p> <p>True ‘comprehensive’ IoT solutions have only been rolled out at scale in selected mines; less progress has been made at smaller scale operations.</p>	<p>Sensors provide real-time productivity monitoring of machinery.</p> <p>Autonomous machinery will improve precision and site productivity (e.g. BHP autonomous truck system, Rio Tinto autonomous heavy-haul rail system).</p>

Case study - Victorian Government On-Farm IoT trial

agriculture.vic.gov.au/agriculture/digital-agriculture/on-farm-internet-of-things-trial

The trial is part of the Victorian Government's \$45 million *Connecting Victoria* initiative to improve digital technology and infrastructure across regional Victoria.

Agriculture Victoria will partner with up to 600 farms across four regions and different farm types to trial on-farm IoT technology and evaluate the impact that these technologies can have on farm performance.

Agriculture Victoria will support the delivery of IoT connectivity to the trial regions and partner with participating farmers to test the impact of IoT on Victorian farms.

The On-Farm IoT Trial will support on-farm adoption of the IoT by addressing barriers to uptake, including:

- Lack of connectivity – The trial is delivering IoT network connectivity to each of the four trial regions.
- Digital literacy – Industry Technology Coordinators with expertise in farm management and digital technology will support farmers participating in the On-farm IoT Trial, including selecting IoT solutions to test that are suitable for their on-farm needs.
- Capital to invest in on-farm IoT technologies – Agriculture Victoria will contribute to the cost of purchasing IoT apps and devices for farmers taking part in the trial.

Barrier to IoT adoption

There are several reasons why growth is not currently more rapid; some of the key hurdles for IoT are:

- Addressing deeply entrenched ways of working industries that can be notoriously resistant to change.
- Significant upskilling may be required.
- Regulatory and compliance adjustments and an improved approach to data privacy may be needed (especially in healthcare).
- Potential lack of a burning platform with commodity prices trending upwards.
- Appropriate communications infrastructure to support the growth of the IoT, such as access to the internet in remote areas (especially in mining and agriculture). This hurdle is quite unique to Australia.
- Industry fragmentation (e.g. agriculture industry is mostly made up of small and medium-sized enterprises that only collectively have the resources to invest in the significant R&D efforts required to drive larger-scale IoT solutions).

5.3 Local government

The 2017 Digital Productivity Report produced by Local Government Association of Queensland (LGAQ) looking at changing digital requirements, maturity and capabilities of local governments across Queensland.

The report found the opportunities:

■ Cloud solutions

The majority of councils are using cloud-based solutions within cost saving to be made. There are challenges with cyber security concerns and the bandwidth restrictions.

■ Shared resources

The report found that councils are willing to collaborate, pool and share resources with each other.

■ IoT, smart cities and communities

The report found there is a rapidly emerging trend towards adopting the smart technologies. Common uses are drones, energy and water asset tracking and fleet monitoring.

One of the key challenges for councils is the skills gaps in employees, and the leading barriers are poor internet coverage and speed, as well as high costs.

5.4 MIW region trends

5.4.1 Reef protection regulations

The Queensland government are introducing new regulations on 1 December 2019 that will address land-based sources of water pollution to the Great Barrier Reef. The new regulations will introduce mandatory record keeping, minimum practice agricultural standard, farm nitrogen and phosphorus budget for sugarcane only, an environmental authority for new or expanded cropping and horticulture activities and new discharge standard for all regulated industrial land use activities.

The increase in farm practicing standards will provide more opportunities for the uptake of location based and IoT applications. The following programs are supporting growers adapt to the new regulations:

- Sugar cane growers - Smartcane Best Management Practice program delivered by Canegrowers
- Horticulture growers - Hort360 program delivered by Growcom.

Feedback from Farmacist, an Agronomics consultancy serving the MIW region, was that there is a general lack of knowledge and resources amongst cane growers to fully adopt digital technology. The new reef regulations will increase workload for growers and there is a need for the adoption of environmental sensors. One example of an opportunity is the use of GPS guidance in chemical spraying with both environmental and safety benefits.

5.4.2 Remote worker welfare

Feedback from Isaac Regional Council and BMA noted that access to mobile and internet services in workers accommodation villages was a reoccurring issue. Quality mobile coverage and access to internet for communications and entertainment was an important welfare issue.

BHP have partnered with NGV Services to provide Wi-Fi, free-to-air and pay TV services to each room and common areas to Buffel Park Village and Eureka Village Camp at Moranbah. NGV's solution was to connect to the 100Mb fibre link back to NextDC B1 and to install a last hop radio link from the mine to the camp.

5.4.3 Industry 4.0

A 'Future Workforces Summit' was held in Mackay in 2019 hosted by GW3. The theme of the Summit was around the opportunities on offer through Industry 4.0 for four key industry sectors (METS/Mining, Construction, Agriculture and Small-Medium Enterprises). The Summit was driven by professionals and futurists in each of the four sectors through keynote presentations as well as panel discussions, primarily covering the following four opportunities:

- IoT
- Big data and analytics
- Automation
- Online Talent Platforms

In 2019 Aurecon released the company's Our Digital Futures research which is designed to help clients understand the state of play around digital challenges and barriers, the possibilities created by digital ways of working and the actions they can take to maximise digitisation opportunities now and into the future.

The research was based on online surveys and deep dive interviews with global business leaders and specialist futurists. The Digital Landscape report released in July 2019 detailed major barriers and challenges around digitisation and provides insights into the opportunities. Opportunities identified were around improving consensus and understanding of digital and the adoption of digital in asset and organisational performance. A copy of the Digital Landscape report is included in **Appendix C**.

6 Digital infrastructure gaps and opportunities

To assess the gaps and opportunities, the results of the audit of the current digital infrastructure in the MIW region was compared to the current government initiatives, the regional benchmarks and the digital infrastructure trends.

6.1 Internet access infrastructure

6.1.1 Fibre

Gap

The east coast is generally well serviced with multiple available fibre optic networks. There is redundancy in the fibre optic networks underutilised by the energy and rail companies.

Opportunity

There is potential opportunity for the Councils to investigate capitalising and expand their fibre optic network.

Case study - City of Gold Coast fibre optic network

www.goldcoast.qld.gov.au/business/fibre-optic-network-48775.html

The City of Gold Coast has invested in an 864-core fibre optic network. The network services Council's CCTV security camera network and public Wi-Fi.

The first stage of the network runs 21 kilometres along the light rail corridor from Helensvale to Broadbeach. A leased fibre connection continues the route for a further 32 kilometres to Coolangatta, providing a high-capacity network through the spine of the city.

A second stage (due for completion in 2019) will run in a 37-kilometre loop from Broadbeach to Burleigh Heads and Robina, then through Nerang to Parkwood and connect to the existing spine at the Gold Coast Health and Knowledge Precinct (Parkwood). This stage is set to support the implementation of digital city projects.

The Council is a licensed carrier and offers 1 Gb per second internet to the Gold Coast Health and Knowledge Precinct (60 times faster than the average connection in the city).

6.1.2 Fixed wireless

Gap

The fixed wireless coverage generally services rural residential areas. The fixed wireless technology relies on a line of sight between the fixed antenna and the base station. Obstacles such as trees and roofs will impact on the coverage and speed of the service.

There are areas within the MIW region that have fixed wireless

Opportunity

NBN Co through their Technology Choice program offer the option for customers to pay to upgrade their connection technology. The program allows for three options:

- Individual premises switch

- Group switch - typically multiple customers in a building or neighbours
- Area switch - a large defined area such as a block or suburb.

The program allows for customers to apply to upgrade the fixed wireless connection to a FTTN or FTTP connection.

This option is a user-pays concept however there is an opportunity for Councils to support an application for an area switch in areas where there is a cluster of businesses reliant on fixed wireless technology.

6.2 Mobile network

6.2.1 Gap

The MIW region has gaps in the mobile network in terms of blackspots and 4G coverage:

- There are a number of documented blackspots through the MIW region that have no or poor coverage.
- There are patches of 3G only coverage which will need investment ahead of the 3G switch off.

Telstra has identified eight mobile base stations in the Mackay urban area for the installation of 5G antennas. There is no confirmed date for the Telstra 5G rollout and no plans for an Optus or Vodafone 5G rollout in the MIW region.

There are also several current systems, including Wilmar's harvester tracking, that are based on 3G technology that will require investment and upgrades ahead of the 3G switch-off in 2024.

The use of IoT applications in the agricultural setting can be supported by a good quality mobile network coverage.

6.2.2 Opportunity

Supporting network rollouts

There is an opportunity for the Councils to continue their support of MBSP funding to reduce the number of blackspots and support further expansion of 4G rollout.

Access to public assets

Site acquisition is a major barrier for carriers in successfully deploying rollouts and there is need for a variety of sites. Suitable assets and infrastructure owned by local government that could be made available include:

- Underground ducts
- Dark fibre networks
- Buildings and other structures
- CCTV networks
- Streetlights and other street furniture

Access to public assets could be facilitated by:

- **Mapping public assets and infrastructure**

There is an opportunity for the region to create a database of suitable assets and infrastructure to encourage investment in blackspot areas.

Councils could create a map and inventory of Council-owned assets suitable for digital infrastructure. Councils could provide information on the ownership structure of the land as well as key considerations such as underground services and easements.

- **Accessing street furniture for network provision**

There is an opportunity to allow network providers access to install and operate network equipment on street furniture. Potential issues include commercial arrangements for access and the availability of power supply.

- **Developing a commercial model for granting access**

Examples of models for Councils to grant access to assets include an open, cooperative asset sharing and concession models.

Case study - UK Government's Digital Connectivity Portal

www.gov.uk/guidance/digital-connectivity-portal

The UK government is aiming to achieve full fibre coverage by 2033 and the majority of the population covered by a 5G signal by 2025.

The Department of Digital, Culture, Media and Sport, as part of their Barrier Busting Taskforce, have developed the Digital Connectivity Portal to:

- encourage closer cooperation between network providers and local authorities and property developers for the deployment of digital infrastructure
- offer guidance on effective policies and processes to facilitate deployment of broadband and mobile networks

Planning incentives

Councils can help create incentives for future investment in digital infrastructure in their area by ensuring the planning scheme effectively support it. Potential incentives include:

- All new developments have sufficient ducting space for:
 - full fibre connectivity
 - mobile base stations
- Appropriate measures to support the effective use of rooftops and street furniture to accommodate mobile digital infrastructure, including small cells for 5G.

Spot fixes

For known areas of poor coverage, there is an opportunity for Councils to install mobile repeaters. The installation of the mobile repeaters can provide a low-cost and location specific fix.

Case study - Lake Elphinstone mobile repeater

<http://blog.cel-fi.com.au/outdoor-mobile-coverage-lake-elphinstone/>

Isaac Regional Council engaged TAA Connect to help fix a mobile blackspot issue at Lake Elphinstone.

TAA Connect set up the solar powered solution to power and house the Cel-Fi GO securely in the amenities block at the site. The Cel-Fi GO stationary model is the strongest repeater on the market.

After install of the solution, Lake Elphinstone campsite now receives a permanent mobile signal around the amenities block and campers are now able to utilise their phones and even data.

Alternative approaches

Shared infrastructure

Currently the competition in the market is insufficient for carriers to provide services to locations with low levels of population or data usage. Collaboration with government and the carriers is required to offer a fair service. There is an opportunity for the three levels of government to collaborate and initiate planning for the MIW region to install geographically located network infrastructure that would provide the optimum tower locations.

With the emergence of the 5G network, there is considerable discussion around the advantages of shared infrastructure to establish the optimum design of the 5G roll-out. There are concerns pertaining to the return on investment required for the business case to roll out 5G networks. Sharing infrastructure would help overcome what is likely to be one of the biggest challenges operators will face in rolling out new infrastructure for 5G.

The GSM Association (GSMA) is a trade body that represents the interests of mobile network operators worldwide. The GSMA lists several ways in which mobile network infrastructure can be shared:

- Sharing of towers or masts, and possibly power supply equipment, but with each operator providing its own base station electronics, backhaul and antennas;
- Sharing of the entire radio access network (RAN), including the site, mast, antenna, base transceiver station (BTS or gNodeB in 5G parlance), backhaul and base station controllers;
- Sharing of the RAN and the spectrum held by each operator;
- National roaming — when a mobile customer uses a network not provided by their operator.

Case study - Rural Connectivity Group NZ

www.thercq.co.nz/

The Rural Connectivity Group was founded in 2017 and is a joint venture between New Zealand's three mobile operators; Vodafone, Spark and 2degrees. The Rural Connectivity Group has partnered with Crown Infrastructure Partners (a New Zealand Government owned company) to build mobile infrastructure.

The Rural Connectivity Group has committed to building over 400 new mobile sites with funding provided by both the New Zealand government and mobile network operators.

Under the venture, all three network operators are sharing antennas, electronic equipment, transmission and power. Each operator owns a third of the capacity from each site, which means they are competing at the retailer level over a single network.

Independent mobile infrastructure providers (IMIP)

IMIP encourages wireless operators to co-locate on our existing sites, helping to minimise the environmental impact of network expansion while offering Australia-wide coverage, faster deployment and lower total costs of ownership compared with building replicated sites.

The benefits and risks associated with mobile network infrastructure sharing are summarised in Table 13 below.

Table 13 Benefits and risks of mobile network infrastructure sharing

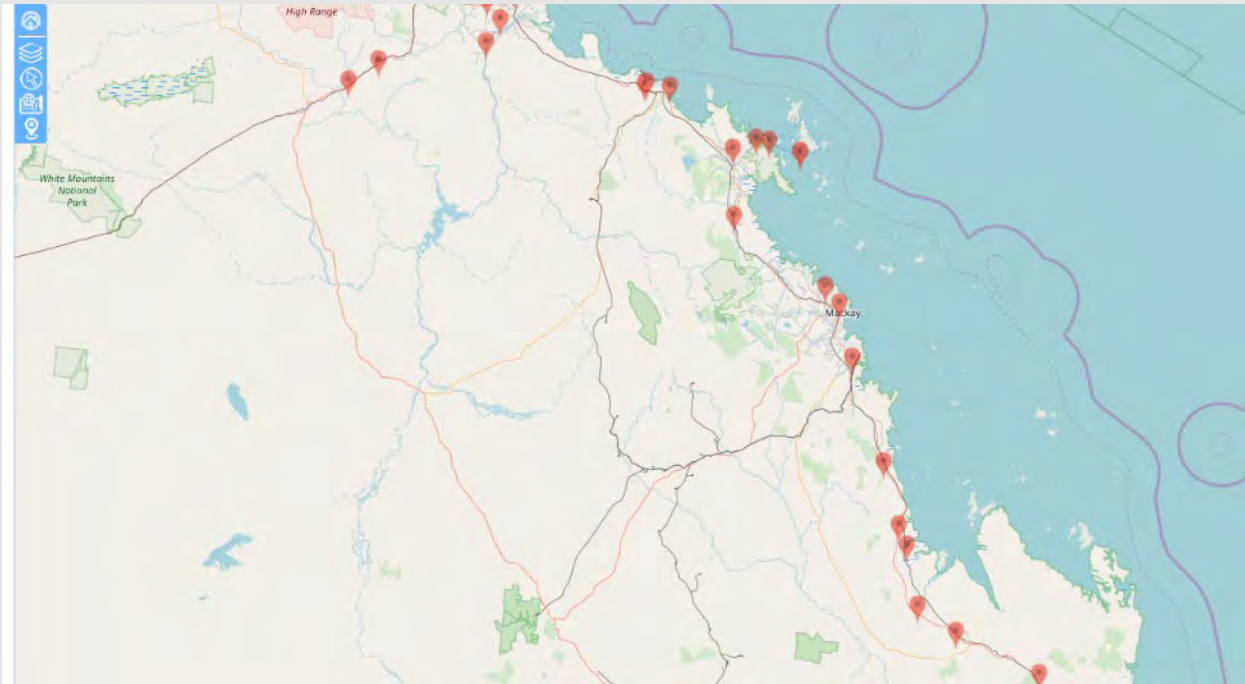
Benefits	Risks
<ul style="list-style-type: none"> ■ Non-proliferation of towers ■ Reduced capital and operational expenditure for carriers ■ Promoting a national network approach ■ Optimisation of existing infrastructure ■ Active network competition, innovation and consumer choice ■ Access for new entrants into the market ■ Low-cost access for government entities 	<ul style="list-style-type: none"> ■ Reduce confidentiality of rollout plans between carriers ■ Conflicting network strategies between carriers ■ Consolidation of the supply chain

Case study - Axicom

www.axicom.com.au/

Axicom, formerly known as Crown Castle, is Australia’s largest independent mobile infrastructure provider (IMIP) who own, operate, build and lease towers and rooftops across the country.

The Axicom portfolio consists of approximately 1,900 tower and rooftop sites across Australia, most of which are leased from land/building owners. There are 12 sites in the MIW region - see Figure 38 below.



Source: Axicom <https://axisites.axicom.com.au>

Figure 38 Axicom sites in the MIW region

Axicom customers include major wireless carriers such as Optus, Vodafone, Telstra and NBN, Emergency services, various State and Federal government agencies, and wireless broadband data service providers.

As an infrastructure supplier with no operating network presence, Axicom facilitates the maximum use of towers on a competitively neutral basis as between individual service providers. Axicom’s aim is to make infrastructure available to co-users for the environmentally and economically efficient deployment of communication networks throughout Australia.

5G ready

There is an opportunity for the MIW region to push for the 5G rollout to be accelerated in the region. A business case for 5G uses would need to be analysed. There is potential opportunity for the METS sector business in Paget to build a case for 5G coverage supporting innovation.

6.3 Global Navigation Satellite System (GNSS)

6.3.1 Gap

GPS accuracy is unreliable for farms in more remote or obstructed areas due to the low density and coverage range of RTK base stations. Compounding this, there is no federated mapping available to determine ideal locations of base stations in the MIW region in terms of position relative to farms, and access. This is a barrier to uptake and application of the technology.

There is also a reluctance to change in that not all farmers currently see significant benefits in automation and are unwilling to invest/subscribe until technology is reliable.

6.3.2 Opportunity

There is an opportunity for further study to determine the viability of expanding/densifying the Mackay Sugar GPS base station network versus exploring other GPS correction technologies such as SBAS. This expansion would be an important step in the establishment of a shared IoT network for agricultural use.

Whilst ensuring reliability will be the most effective way of incentivising uptake of precision agriculture technologies, there is an opportunity for Government assistance to lessen the financial burden on farmers and increase industry confidence. This approach has been adopted by the Victorian Government through their \$45 million *Connecting Victoria* initiative in 2019. Through this, on-farm IoT technology was trialed on 600 farms of various types to test impact on efficiency.

There is also an opportunity to use GIS mapping for determining ideal base station locations to best serve all farms.

6.4 Internet of Things (IoT) LPWAN

6.4.1 Gap

There is currently no known open LPWAN in the MIW region. An open LPWAN would encourage start-ups and amateurs to development IoT networks.

6.4.2 Opportunity

There is an opportunity to establish an open or commercial LPWAN network on the back of Council owned/operated network.

A Council funded network could promote to businesses and the community the value that can be created from deployment of low cost sensors. A LoRaWAN network could be rolled out with the delivery of other new council services such as waste management, parking, and additional water monitoring, while allowing open access to others to put their own devices on the network cost effectively. The sensors that provide a multi-year solution (one that does not require an external power source or regular battery replacement) would be most feasible.

A Council funded network which almost certainly best operated by a third-party network service provider. There is limited opportunity to piggyback on the existing Taggle network in Mackay and Isaac due to the age and specific design of the technology.

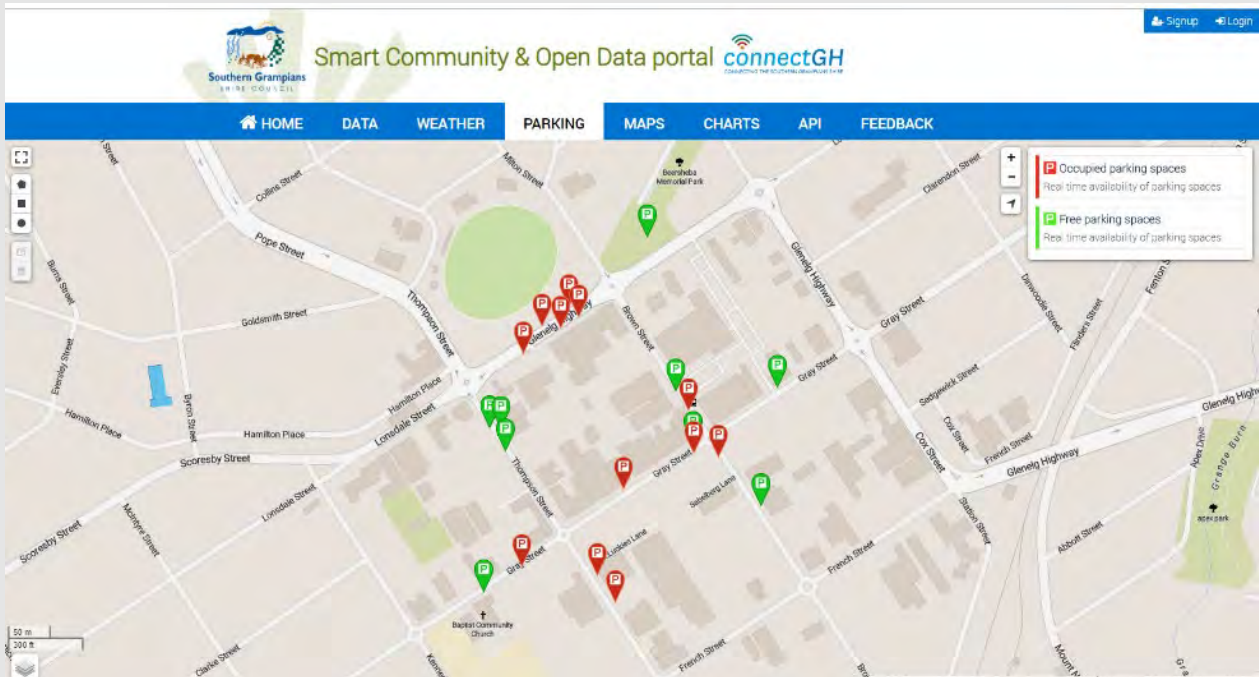
Case study - connectHG

www.connectgh.com.au

The Southern Grampians Shire Council in south-west Victoria developed an LoRaWAN IoT platform. Council has piloted a number of sensor-based technologies with weather stations and parking sensors currently in place. Soil moisture, water level and bin sensors are being trialled. The weather station and parking sensor data is available in real-time to the public online.

The network was made available for free to the public via The Things Network.

As part of the program Council have funded a local business to upskill in LoRaWAN technology allowing the business to further support LoRaWAN solutions in the local area. The project was supported by the Commonwealth government through the Smart Cities and Suburbs program.



Example of parking sensor live data

Case study - Lake Macquarie LoRaWAN

www.lakemac.com.au/smart-city/lorawan

Two types of long-range low power wide area network (LoRaWAN) are now available in Lake Macquarie:

- a **public network** - Council and the community are progressively building up a map of the public network. The network can be accessed via [The Things Network Lake Macquarie and Newcastle Community](#).
- a **commercial-grade network** - Lake Macquarie is the first city in Australia with city-wide coverage of a commercial grade network.

To encourage use of the commercial network and attract business to the region, tech start-ups will be given free access and businesses and corporates will receive a 15 per cent discount if they establish operations in Lake Macquarie City. The council has already established partnerships with corporations such as the University of Technology Sydney, Slingshot, Ampcontrol, ResTech and Hunter Water, as well as start-ups such as Marine Connect, Liftango and BinShare, all of which are primed to use the network.

The network is commercially funded for a 20-year contract period, delivered via a partnership between Dantia, Lake Macquarie City Council and IoT provider The National Narrowband Network Co (NNNCo).

6.5 Public Wi-Fi hotspots

6.5.1 Gap

There is no large-scale public Wi-Fi offered in the MIW region. There are potential benefits for place activation and data collection.

The location of public Wi-Fi can increase visitation; for example:

- Public Wi-Fi facilities at photogenic tourist attractions may increase the likelihood of social media sharing from visitor
- The introduction of public Wi-Fi at a library could create a remote working hub.

6.5.2 Opportunity

There is an opportunity to introduce public Wi-Fi at strategic tourist locations. Public Wi-Fi at Cape Hillsborough or Whitehaven Beach could increase the likelihood of tourist sharing their experiences and therefore increasing exposure. Tourism stakeholders including Mackay Tourism has noted that international tourists are more likely to connect with public Wi-Fi as they do not have a device with a SIM card to connect to the mobile phone network.

There is an opportunity for the expansion of eduRoam Wi-Fi network. eduRoam is a secure global roaming wireless network for the research and education sector. eduRoam in Australia is operated by AARNet.

Case study - Rockhampton CBD eduRoam expansion

rockhamptonregion.qld.gov.au/AboutCouncil/News-and-announcements/Latest-News

CQUniversity has partnered with Rockhampton Regional Council to sponsor and facilitate a roll-out of the eduRoam global wireless access service across Council's public network, including the riverfront precinct.

The University's role included building a fibre connection to the Council to enable the service (which runs over Rockhampton Regional Council's wireless network and connects to the internet via the University's AARNet connection). The initiative secures online Wi-Fi access for university students wherever the council offers its free WI-FI network.

Since eduRoam went live in late September 2019, there has been over 2,200 individual users including students, staff and academics with the CBD being the most popular location, followed by Kershaw Gardens. With connections from our CQUniversity students, but also from 31 other universities and institutions including from London, Germany, and Singapore.

6.6 Remote Operating Centres (ROCs) and Remote Asset Management Centres (RAMCs)

6.6.1 Gap

Considerable discussions have been held by development agencies on whether a Mackay or Moranbah based remote operations centre would present benefits to Bowen Basin miners. There are some technology and infrastructure barriers to facilitate the creation of secure and effective digital systems for remote control operations. Major mining companies would need the same connectivity and modern digital infrastructure as the current BHP private Brisbane data connections for Mackay and Moranbah to be viable.

6.6.2 Opportunity

The Queensland Resources Council are considering research into a remote operations centre project to look at an industry approach to improving digital infrastructure, in a coordinated way.

7 Recommended regional priority actions

7.1 Overview

Investment in digital infrastructure will impact on MIW region's ability to respond to changing work and life styles by:

- **Enhancing data access** improving remote working and supporting the gig economy
- **Supporting emerging automation** including the Industry 4.0 technologies and autonomous vehicles
- **Expanding cost effective data capture** with smart city and agricultural technologies.

Based on the analysis of the current digital infrastructure and the gap analysis, the following key action areas were identified:

- **Identifying Council-led digital infrastructure options** to take advantage of existing infrastructure and to support IoT technology take-up
- **Facilitating the improvement of the mobile network** through a region-based approach and resourceful solutions
- **Establishing place specific infrastructure** to encourage place activation.

The recommended actions are drafted to act as a digital infrastructure roadmap for the MIW region.

Establishing individual Council working groups would be a first step for Councils to assess the feasibility and business case of implementing the recommended actions in their LGAs. The working groups will encourage discussion regarding the adoption of the recommendations and schedule their implementation as appropriate.

Councils in conjunction with other lead partners should ensure that the recommended digital infrastructure actions are integrated with other objectives such as:

- **economic development** - local business skills training, investment attraction
- **environmental** - environmental monitoring, renewable energy targets
- **Council governance** - asset management, data sharing, community engagement.

A dedicated strategy would complete other local and regional plans.

7.2 Action lead and partners

Lead/s and partner/s have been nominated for each action item. It is foreseen the action lead would plan and manage the action item with support from the action partner. Funding for the actions would be sourced from either the lead, partner or a third party.

The following government departments have been included as action leads and/or partners:

- **Commonwealth Department of Infrastructure, Transport, Regional Development and Communications** - as the Commonwealth government department implementing the mobile blackspot program
- **Queensland Department of Agriculture and Fisheries** - as the Queensland government department with interests in agritech development

- **Queensland Department of Environment and Science** - as the Queensland government department responsible for National Park
- **Queensland Department of Public Works and Housing** - as the Queensland government department with interests in digital infrastructure and the mobile blackspot program

The following industry group have been included as action leads and/or partners:

- **Mobile carriers** - Telstra, Optus and Vodafone
- **NBN Co** - as the primary broadband provider
- **AARNET** - as a major internet infrastructure provider
- **Independent mobile infrastructure providers** - as potential infrastructure partners
- **Mackay Tourism** and **Tourism Whitsundays** - as peak tourism industry representatives
- **METS industry**

7.3 Recommended actions

The following is a summary of the recommended priority actions:

	Establish Council working groups	Identify Council-led digital infrastructure option	Facilitating the improvement of the mobile network	Establishing place specific infrastructure
Focus 0-18 months	<ul style="list-style-type: none"> ■ Each Regional Council create a Working group to unlock digital opportunities in their LGA 	<ul style="list-style-type: none"> ■ Public, open LoRaWAN network 	<ul style="list-style-type: none"> ■ Coordinated blackspot funding approach ■ Accelerated 5G rollout ■ Spot fixes 	<ul style="list-style-type: none"> ■ Expansion of public Wi-Fi
Accelerate 18-36 months		<ul style="list-style-type: none"> ■ Commercial LoRaWAN network ■ Council as a fibre network provider 	<ul style="list-style-type: none"> ■ Fixed wireless technology upgrades ■ Planning incentives 	<ul style="list-style-type: none"> ■ Shared IoT network for agricultural use ■ Expansion of the GPS base station network

Table 14 MIW region digital infrastructure recommended priority actions

Action		Focus 0-18 months	Accelerate 18-36 months	Lead	Partner	Next steps
Establish individual Council working groups						
1. Each Regional Council create a Working group to unlock digital opportunities in their LGA	Mackay, Isaac and Whitsunday Regional Councils each commit to forming a working group to facilitate discussions regarding the adoption of recommended priority action items 2-7, 9 and 10.	●		Mackay Regional Council Isaac Regional Council Whitsunday Regional Council		Establish working groups
Working groups assess the feasibility of extending the use of Council-owned digital infrastructure						
2. Public, open LoRaWAN network	Potentially offering a public, open, low-cost LoRaWAN network in conjunction with the delivery of other Council services	●		Regional Council working groups	The Things Networks	Assess the technical feasibility Council decision
3. Commercial LoRaWAN network	Potentially establishing a commercial IoT network piggybacked off the public LoRaWAN network		●	Regional Council working groups		Cost-benefit analysis Council decision
4. Council as a fibre network provider	Potentially establishing of Council-owned commercial fibre optic network piggybacked off existing fibre infrastructure		●	Regional Council working groups		Cost-benefit analysis Council decision
Facilitating the improvement of the mobile network						
5. Coordinated blackspot funding approach	Develop a regional approach to Mobile Blackspot Funding by: <ul style="list-style-type: none"> Developing a list of priority blackspot sites with a focus on roads, tourist attractions and workers accommodation villages 	●		GW3	Regional Council working groups Mobile carriers	GW3 to review current blackspots and liaise with Council on prioritisation

	Action	Focus 0-18 months	Accelerate 18-36 months	Lead	Partner	Next steps
	<ul style="list-style-type: none"> ■ Mapping Council and other public assets suitable for hosting mobile base stations or small cells ■ Engaging with independent mobile infrastructure providers to provide blackspot solutions 				Independent mobile infrastructure providers Queensland Department of Public Works and Housing Commonwealth Department of Infrastructure, Transport, Regional Development and Communications	
6. Accelerated 5G rollout	Advocate to the carriers for an accelerated 5G rollout in the MIW region	●		Regional Council working groups GW3	METS industry Mobile carriers	GW3 to lead advocacy efforts
7. Spot fixes	Develop a list of areas of poor coverage suitable for low-cost spot fixes funded by Council	●		Regional Council working groups GW3	Mobile carriers	GW3 to lead liaison with Councils
8. Fixed wireless technology upgrades	Develop a list of potential locations suitable for fixed wireless technology upgrades through the NBN Technology Choice program		●	GW3	NBN Co	GW3 to lead liaison with NBN Co
9. Planning incentives	Review current planning policies for opportunities to encourage mobile network infrastructure in new development including mobile base stations and small cells		●	Regional Council working groups	Queensland Department of State Development, Manufacturing, Infrastructure and Planning	GW3 to advocate for consistency in approach across Councils

Action		Focus 0-18 months	Accelerate 18-36 months	Lead	Partner	Next steps
Establishing place specific infrastructure						
10. Expansion of public Wi-Fi	Investigate the expansion of the eduRoam Wi-Fi network to the Mackay and Whitsunday council public Wi-Fi networks	●		Regional Council working groups AARNET	CQUni	GW3 to inform the process
	Identify value-adding opportunities for public Wi-Fi in tourist locations	●		GW3	Queensland Department of Environment and Science Mackay Tourism Tourism Whitsundays	GW3 to inform the process
11. Shared IoT network for agricultural use	Develop a program to accelerate the adoption of IoT technology through the establishment of a shared IoT network for agricultural use		●	GW3 Queensland Department of Agriculture and Fisheries	Mackay Sugar Canegrowers	GW3 to initiate discussion and progress opportunities
12. Expansion of the GPS base station network	Examine the feasibility of expanding the Mackay Sugar GPS base station network for broader precision agriculture, including exploring alternate GPS correction technologies and GIS mapping of ideal base station locations		●	GW3 Queensland Department of Agriculture and Fisheries	Mackay Sugar Canegrowers	GW3 to initiate discussion and progress opportunities

7.4 Potential funding sources

Potential grants and other funding opportunities to support the recommended actions are listed in Table 15 below.

Table 15 Potential funding sources

Government source		Program
Commonwealth government	Department of Infrastructure, Transport, Regional Development and Communications	Mobile Black Spot Program Provides funding support to invest in telecommunications infrastructure to improve mobile coverage and competition across Australia.
		Regional Connectivity Program Designed to target investment to local priorities to maximise economic opportunities and region-wide benefits for regional, rural and remote Australians. The Government is investing \$53 million in telecommunications infrastructure projects as part of this program
	Department of Infrastructure, Transport, Cities and Regional Development	Smart Cities and Suburbs Program Supports projects that apply innovative technology-based solutions to urban challenges. Aims to improve the liveability, productivity and sustainability of Australian cities, suburbs and towns.
		Building Better Regions Fund (BBRF) Invests in projects located in, or benefiting eligible areas outside the major capital cities of Sydney, Melbourne, Brisbane, Perth, Adelaide, and Canberra. In particular, the Infrastructure Projects Stream supports projects that involve construction of new infrastructure, or the upgrade or extension of existing infrastructure.
		Community Development Grants (CDG) Programme Supports needed infrastructure that promotes stable, secure and viable local and regional economies.
Department of Agriculture	National Landcare Program: Smart Farms Small Grants Support for projects to increase farming, forestry and fishing communities' awareness, knowledge, skills and capacity to adopt best practice sustainable agriculture.	
State government	Advance Queensland (Department of Innovation and Tourism Industry Development)	Advancing Regional Innovation Program Supports the development and increased maturity of regional innovation initiatives. Aims to promote collaboration, leverage, sustainability and positive impact.
		Industry Attraction Fund Seeks to bring contestable projects to Queensland in order to drive job creation, regional growth, increased innovation and technology and supply chain development.

Government source		Program
		<p>Innovation Partnerships Grants</p> <p>Supports research organisations to undertake collaborative research projects with end-users (industry, small to medium size enterprises, public sector and non-government organisations) that address an industry or end-user issue, within the parameters of the Queensland Science and Research Priorities and the Advance Queensland Roadmaps.</p>
		<p>Business Growth Fund Program</p> <p>Provides targeted assistance for small and medium businesses to purchase and implement highly specialised equipment and services to enable them to move to the next stage of growth.</p>
	Department of Innovation and Tourism Industry Development	<p>Attracting Tourism Fund</p> <p>Facilitates the development of infrastructure and experiences that will attract, grow and sustain visitation from international priority source markets with flow-on economic benefits to Queensland's visitor economy.</p>
	Queensland Reconstruction Authority	<p>Disaster Resilience Fund</p> <p>Provides assistance to local governments, state agencies and non-government organisations to deliver mitigation and resilience projects.</p>
	Department of State Development, Manufacturing, Infrastructure and Planning	<p>Building our Regions Program</p> <p>Provides funding to eligible local councils for critical infrastructure in regional areas of the state, while also supporting jobs, fostering economic development and improving the liveability of regional communities.</p>
	Department of Local Government, Racing and Multicultural Affairs	<p>Local Government Grants and Subsidies Program</p> <ul style="list-style-type: none"> ■ Assists projects that support economic growth, innovation and community development, increasing local job creation and training opportunities. ■ Assists projects that contribute to building safe, caring and connected communities, enhancing access to infrastructure and services.

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Appendix A

Stakeholder information

Industry stakeholders






Industry	Organisation	Relevance to region
Agribusiness	Farmacist	Agronomics consultancy serving the MIW region
Agribusiness	Wilmar Sugar	Sugar milling company operating in the Mackay and Whitsunday region
Education	CQUniversity	Main higher education provider in the MIW region
Government	Department of Housing and Public Works	Queensland department responsible for the State Digital Infrastructure Plan
Government	Regional Development Australia (RDA) MIW	Commonwealth government initiative for regional development
IT industry	Geoff Fleming	Individual with experience in the MIW IT sector
IT Industry	Jim Whelan	Individual with experience in the MIW IT sector
Mining and METS	Aurizon	Rail freight company
Mining and METS	BHP Billiton	Owner and operator of several Bowen Basin mines and Hay Port coal terminal
Mining and METS	METS Export Hub	Commonwealth and State government initiative for the MIW METS sector
Mining and METS	METS Ignited	Commonwealth government initiative for the METS sector
Mining and METS	Queensland Resources Council	Industry association for Queensland's minerals & energy resources sector
Service provider	AARNET	Internet and communication service provider for the education sector
Service provider	NBN Co	Internet service wholesaler
Service provider	Optus	Mobile carrier and internet service provider
Tourism	Mackay Tourism	Tourism industry group for the Mackay and Isaac region
Tourism	Tourism Whitsundays	Tourism industry group for the Whitsunday region
Tourism	Whitsunday Charter Boat Industry Association	Local Whitsundays tourism association

Appendix B

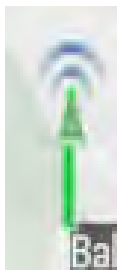
NBN coverage maps

The following maps show the available NBN technology, as of 27 November 2019:

- Areas coloured are serviced by a fixed line connection

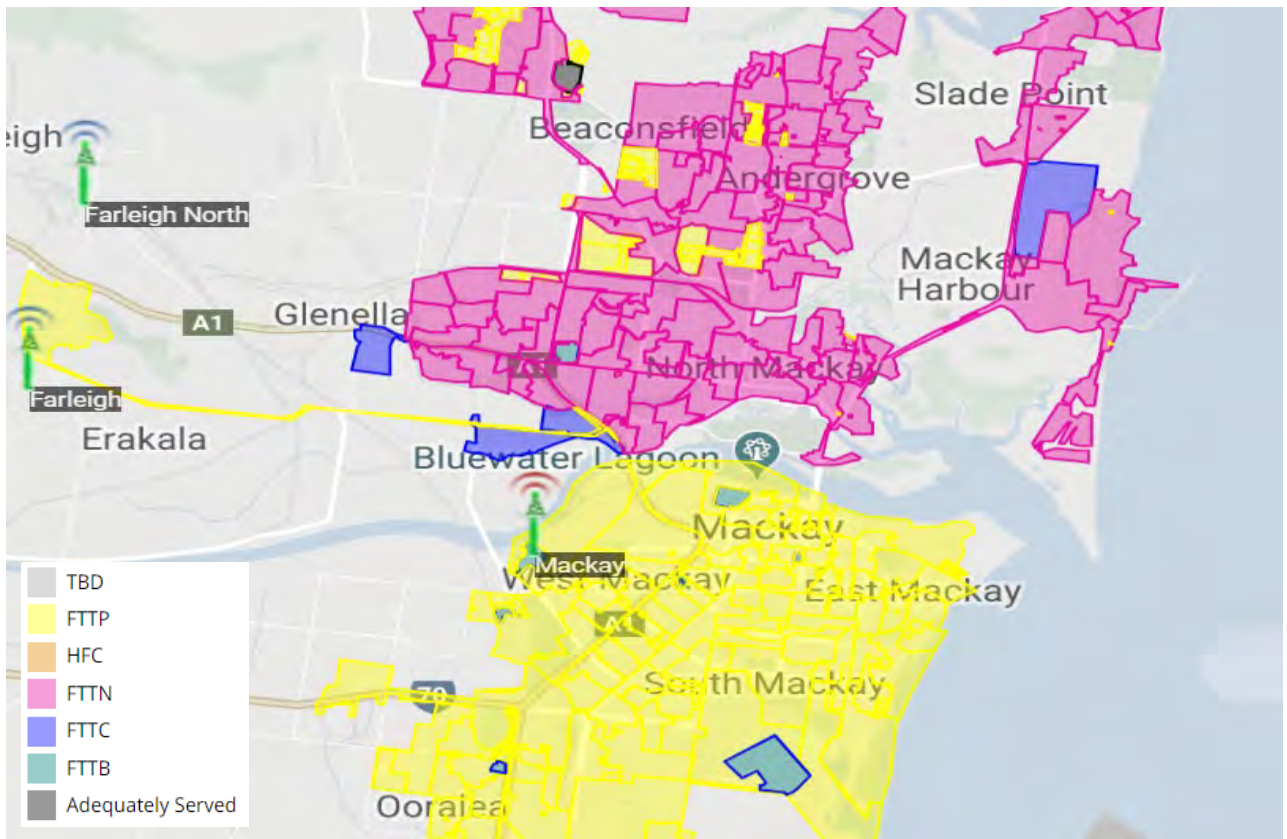
	FTTP	Fibre to the premises
	HFC	Hybrid Fibre Coaxial
	FTTN	Fibre to the node
	FTTC	Fibre to the curb
	FTTB	Fibre to the building

- Fixed wireless base stations are shown with this symbol

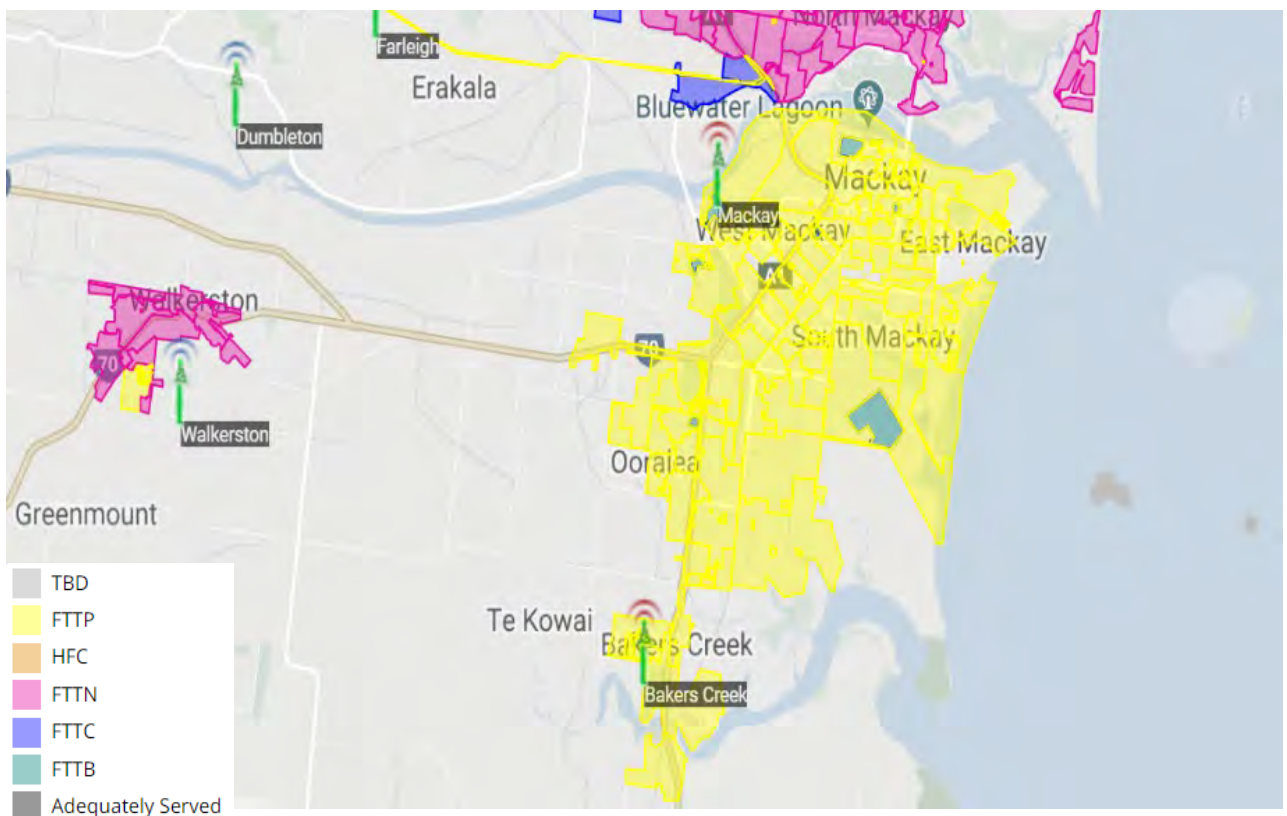


Mackay LGA

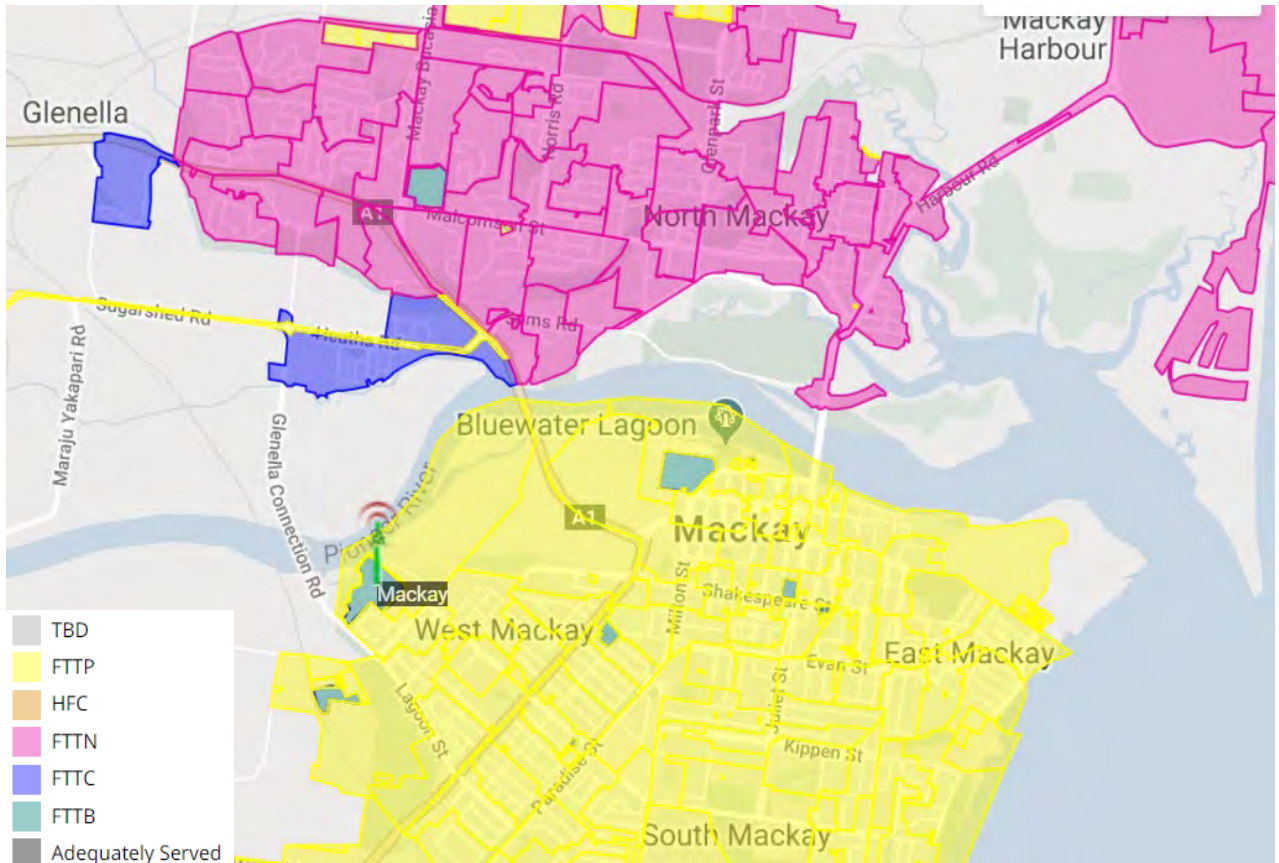
Mackay City & Northern Beaches



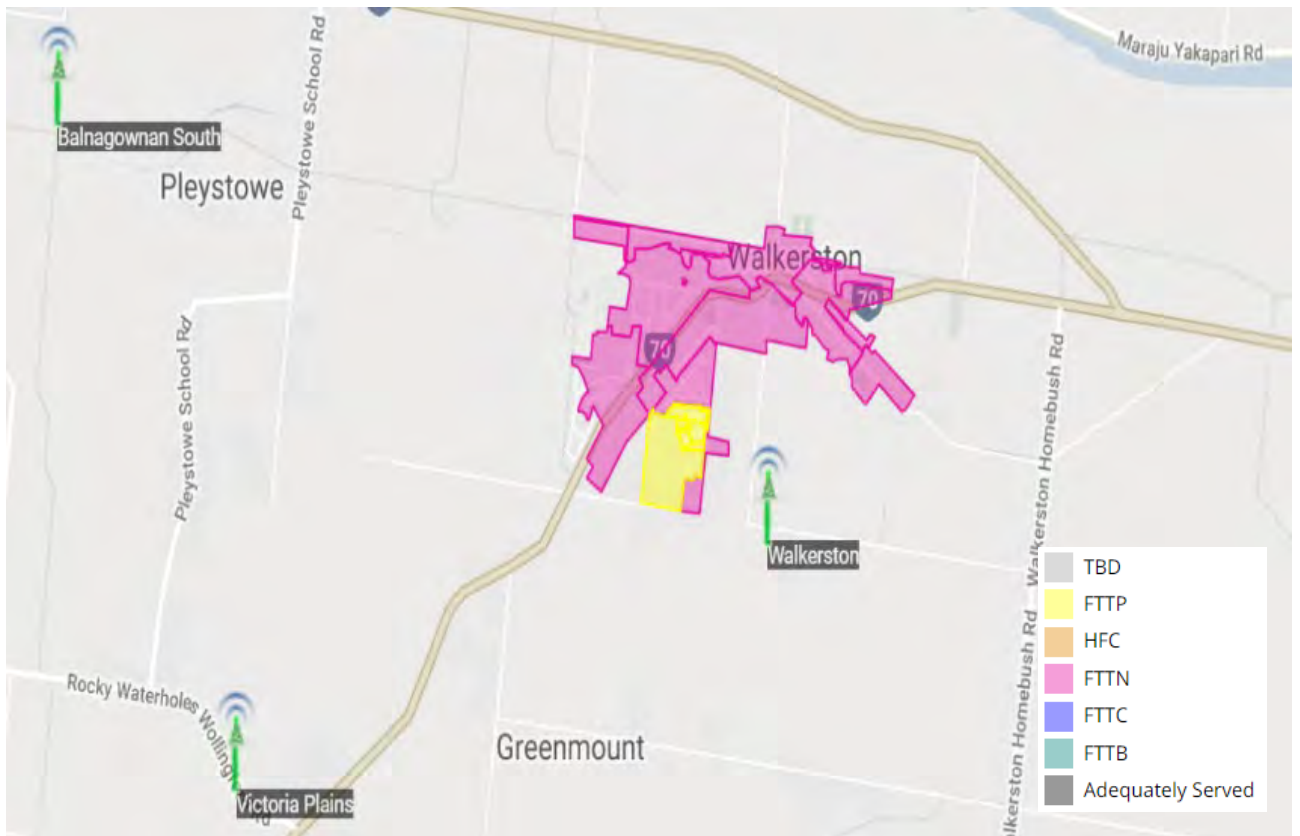
Mackay -southern suburbs



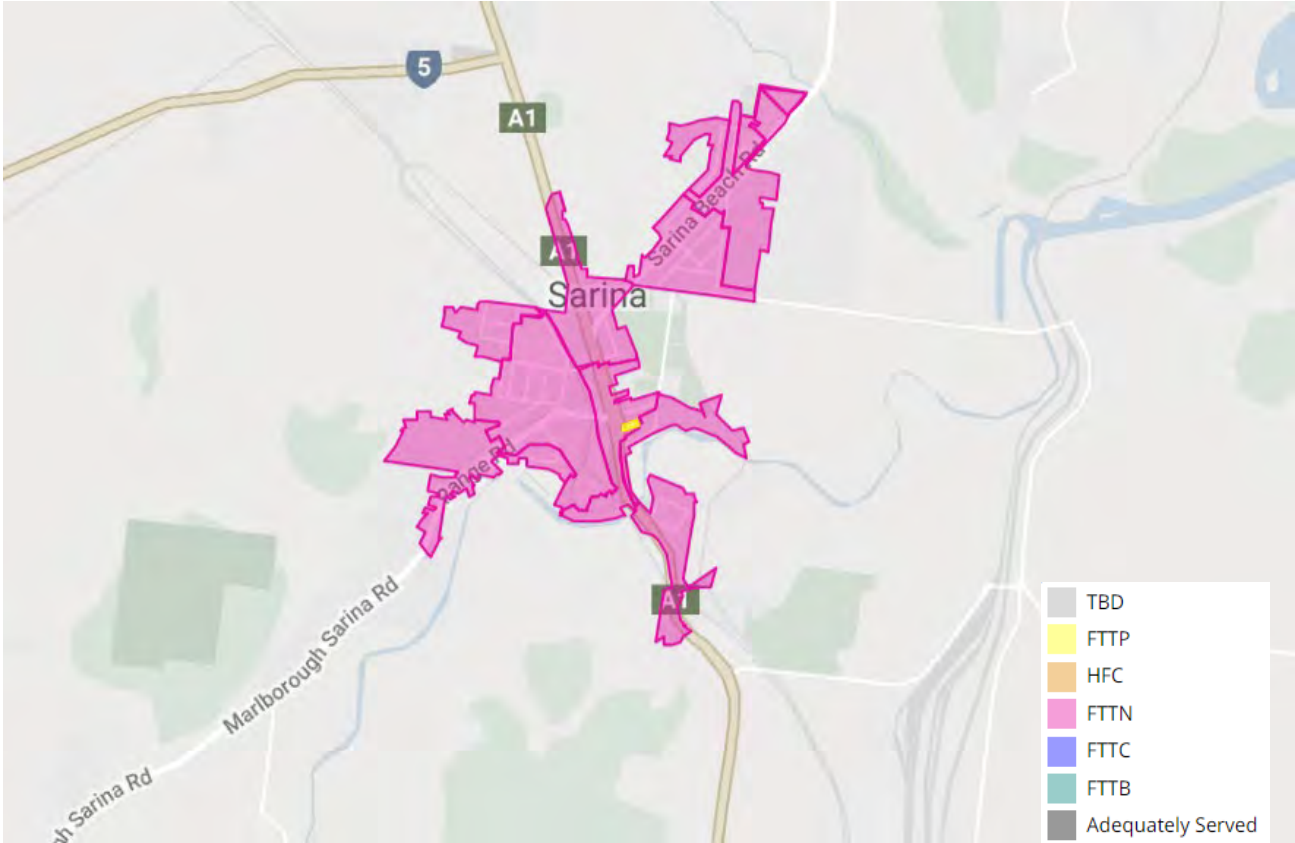
Mackay CBD



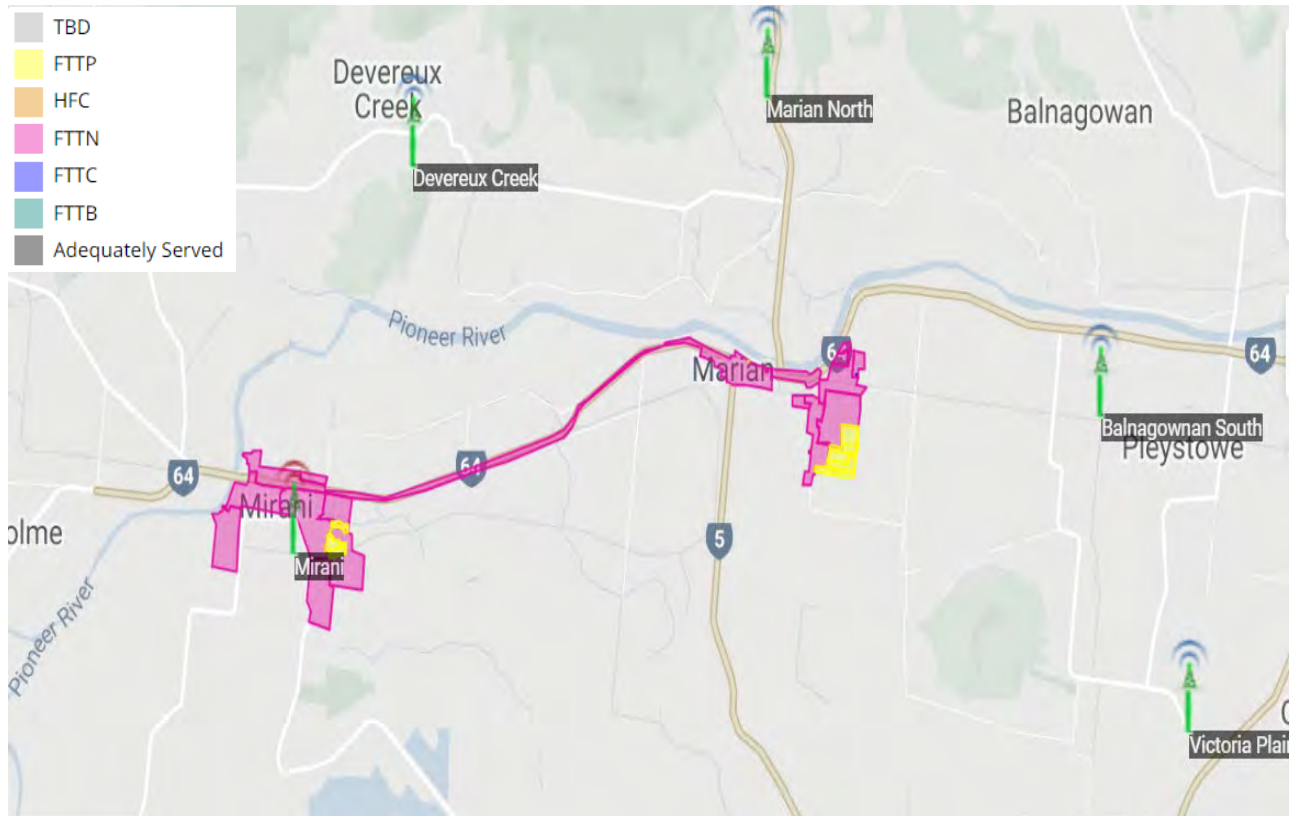
Walkerston



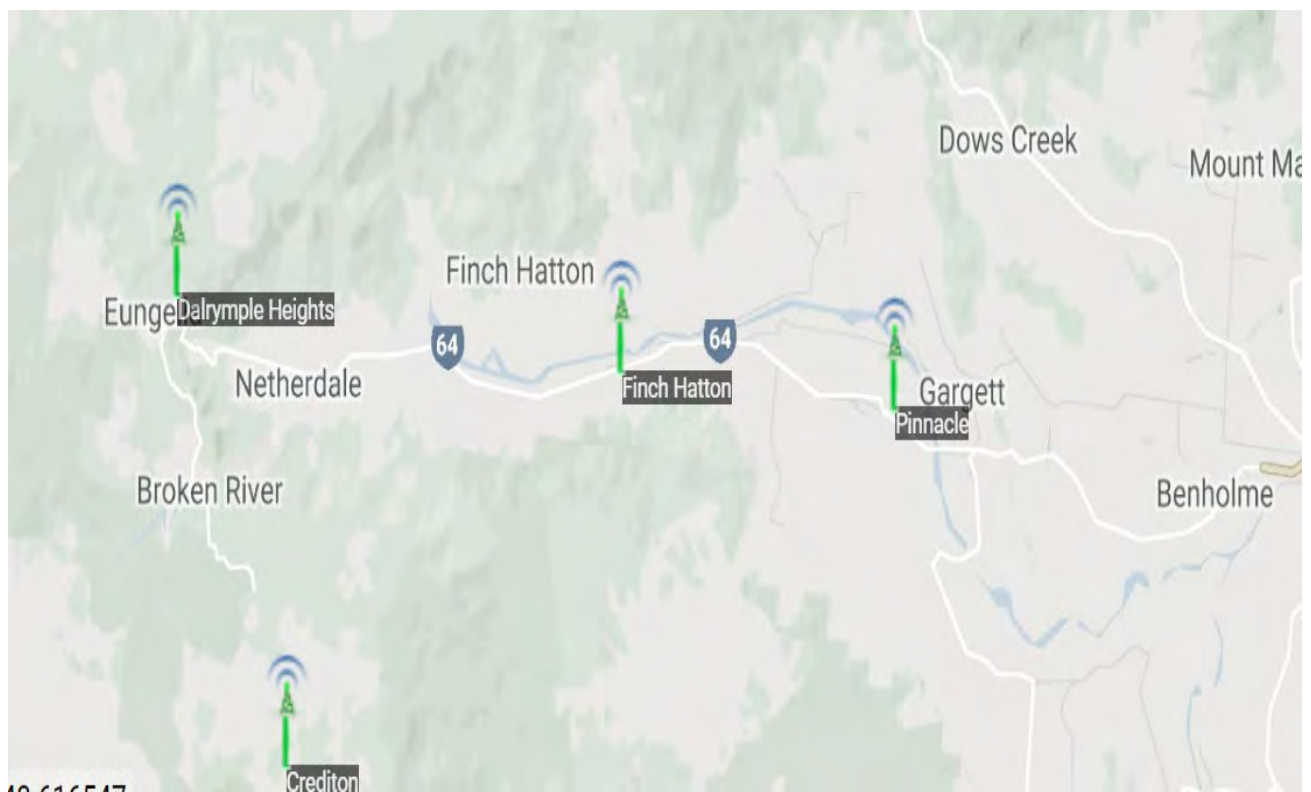
Sarina



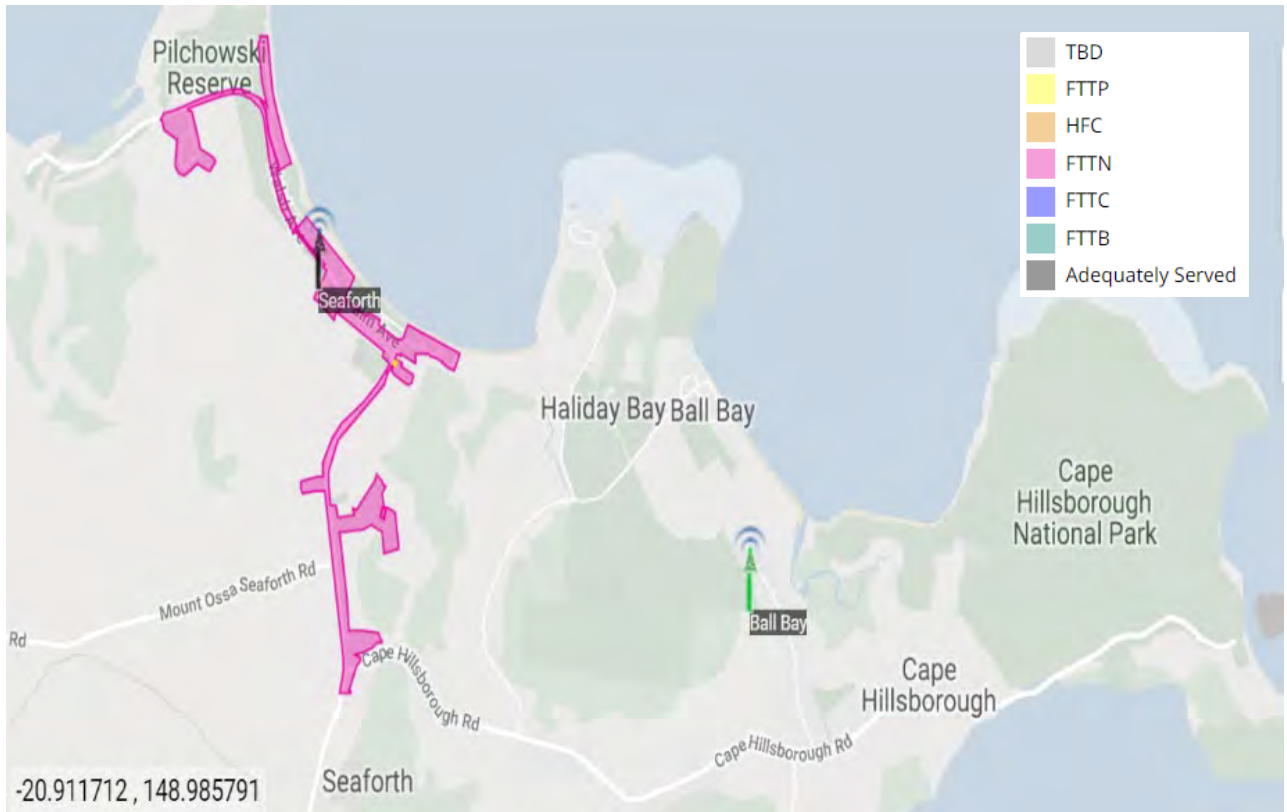
Mirani and Marian



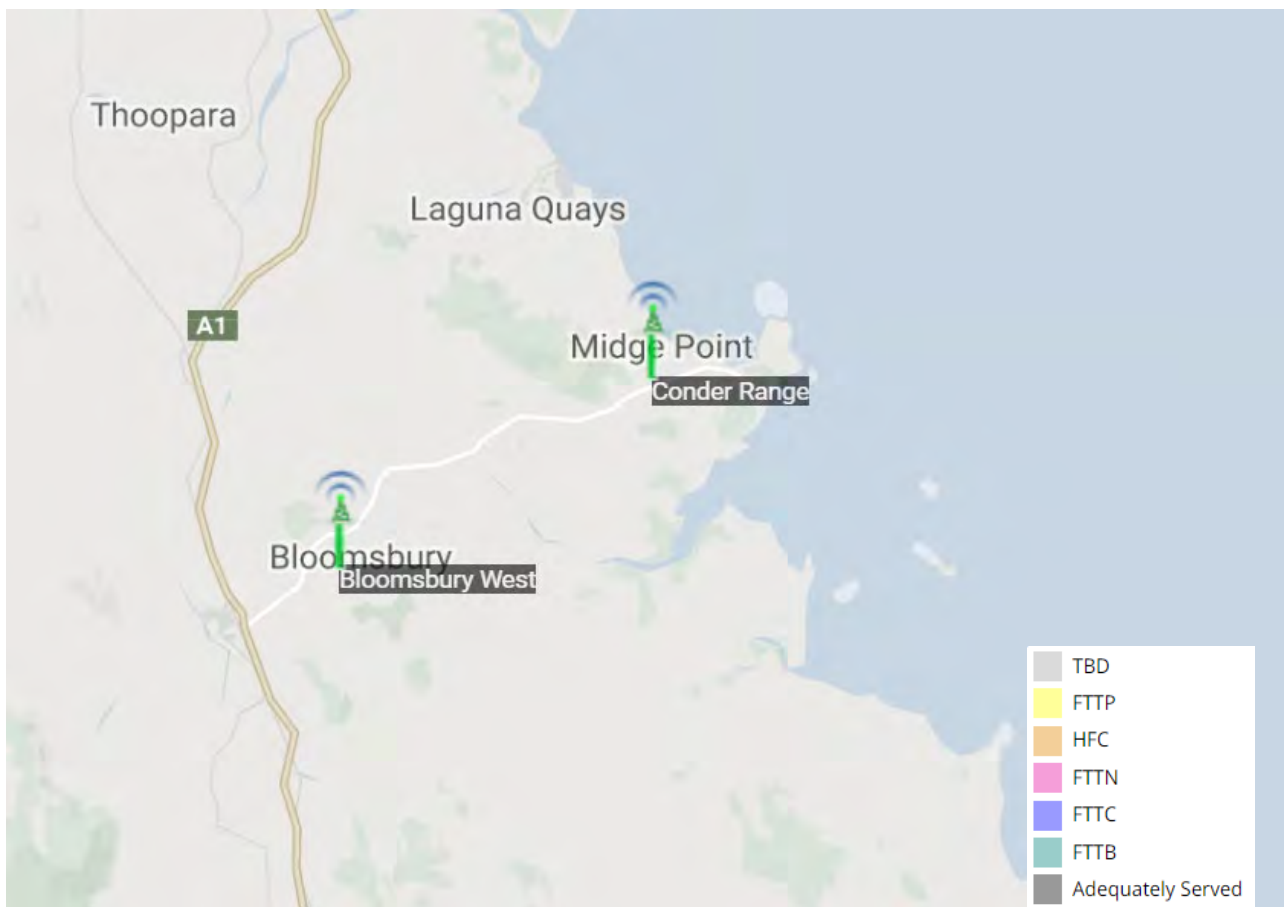
Finch Hatton



Seaforth & Ball Bay



Midge Point

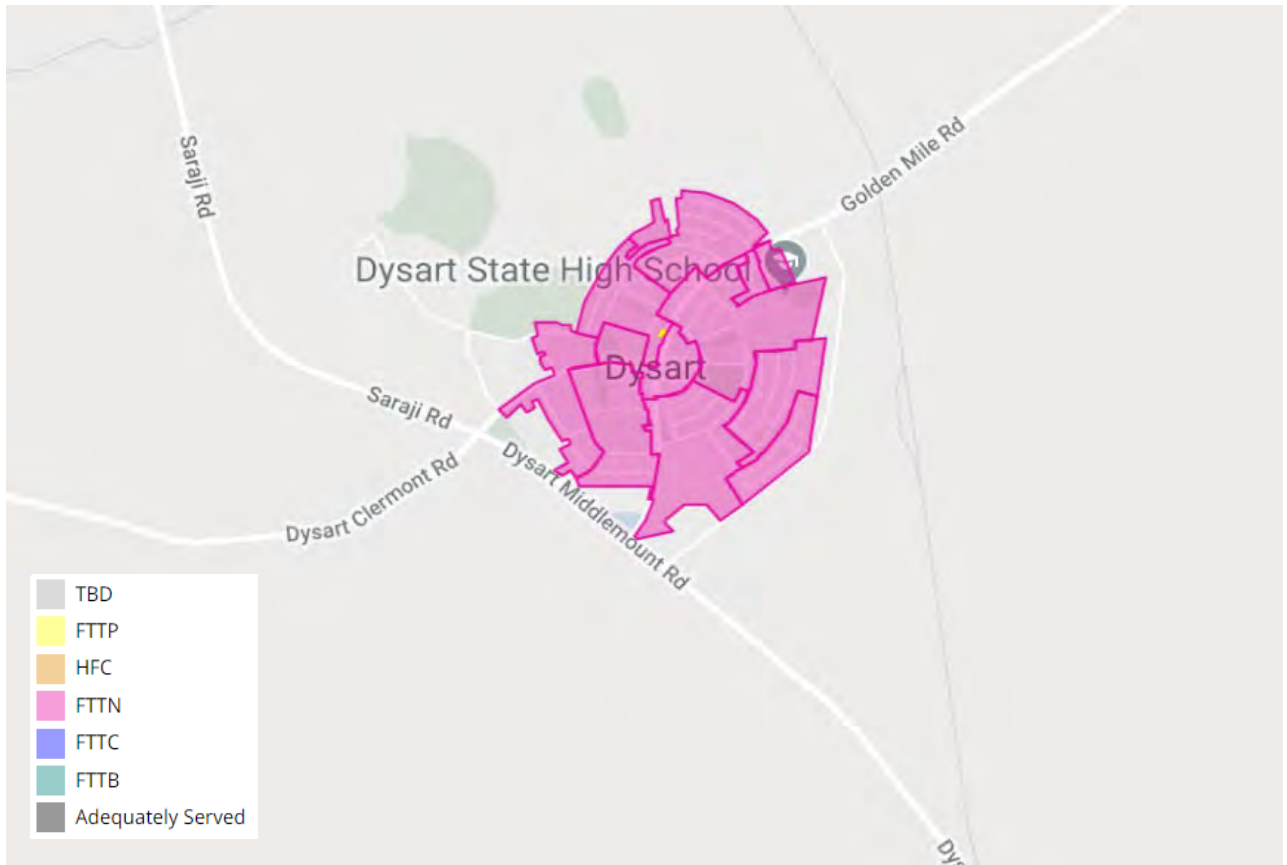


Isaac LGA

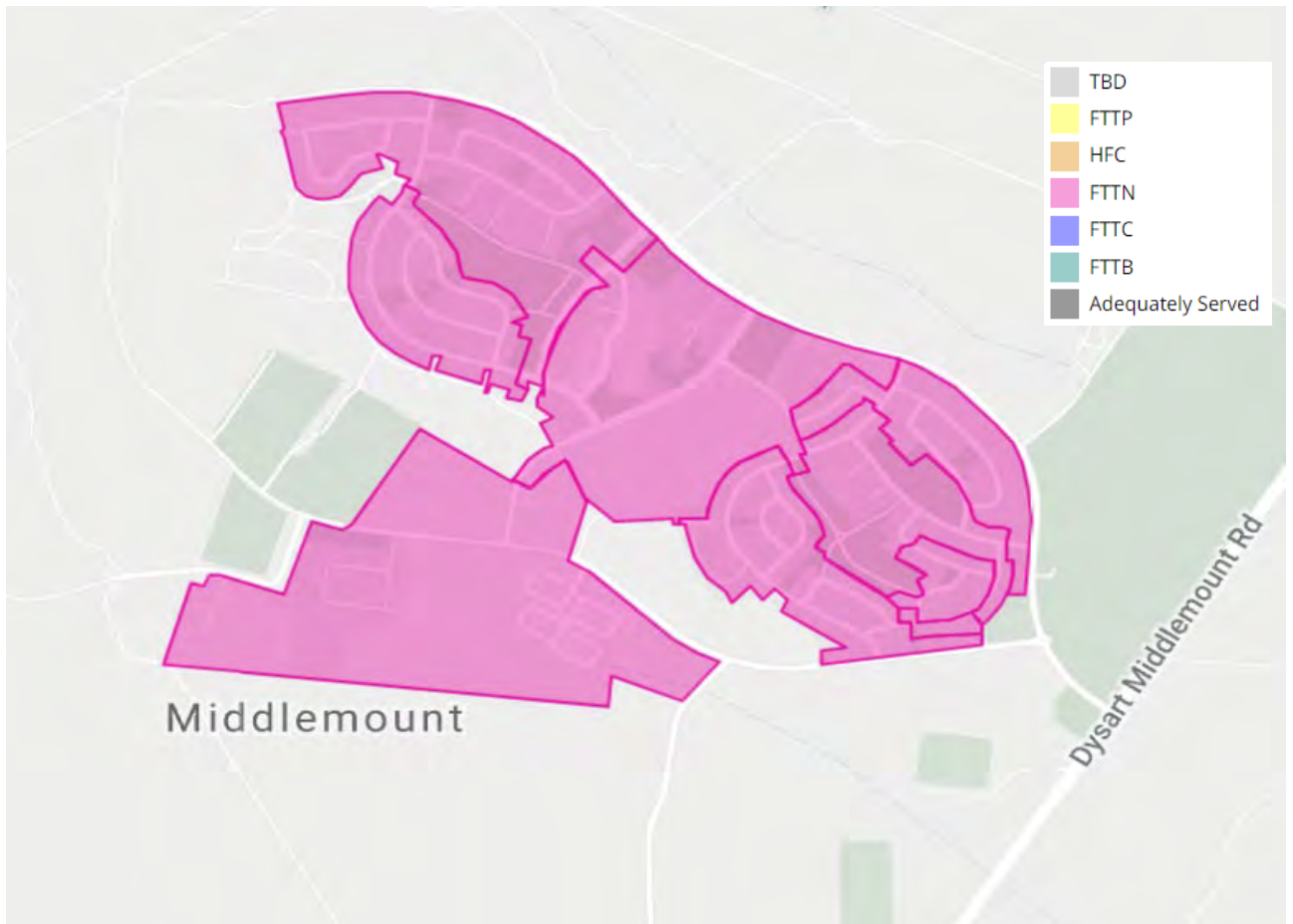
Glenden



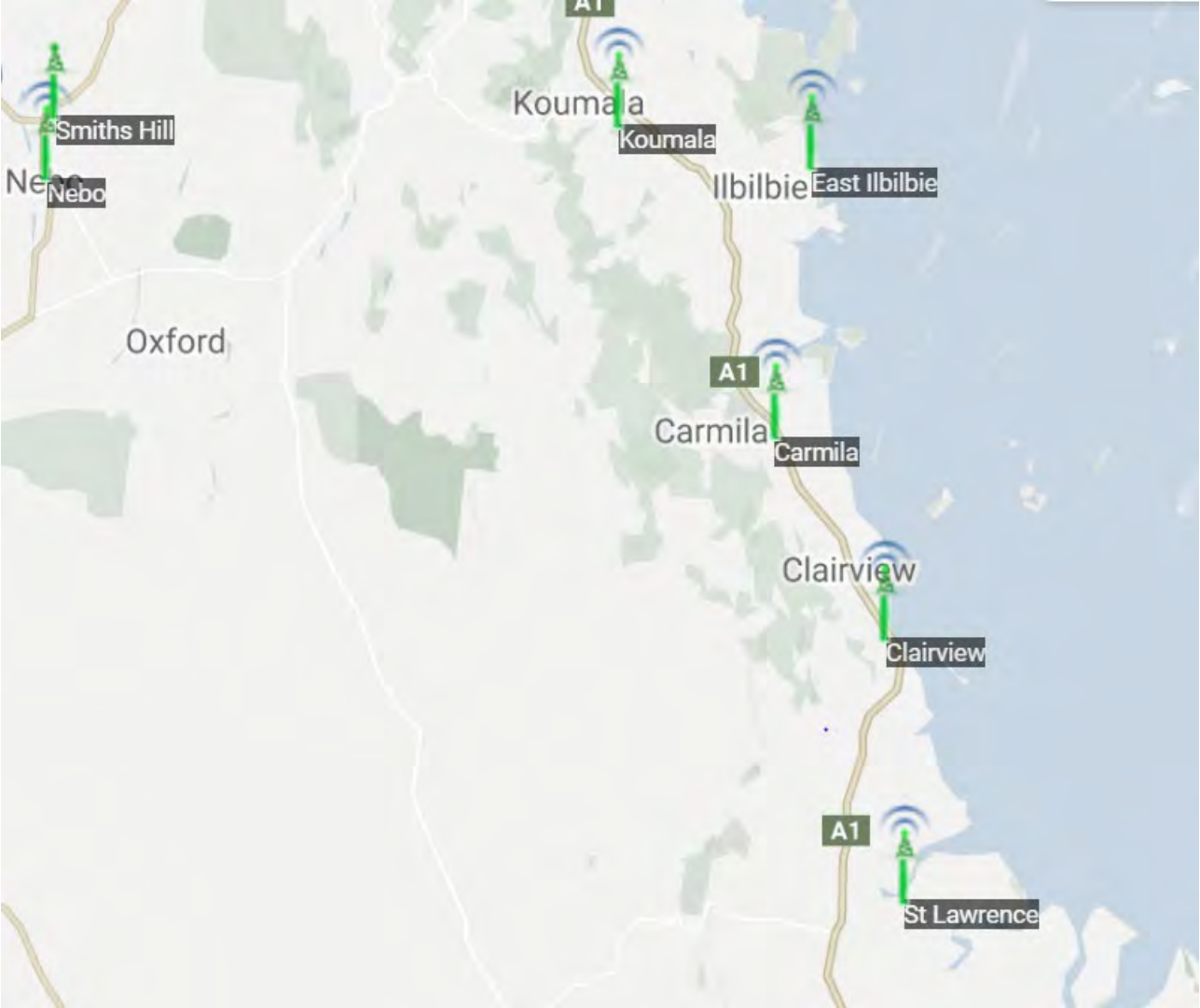
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Middlemount

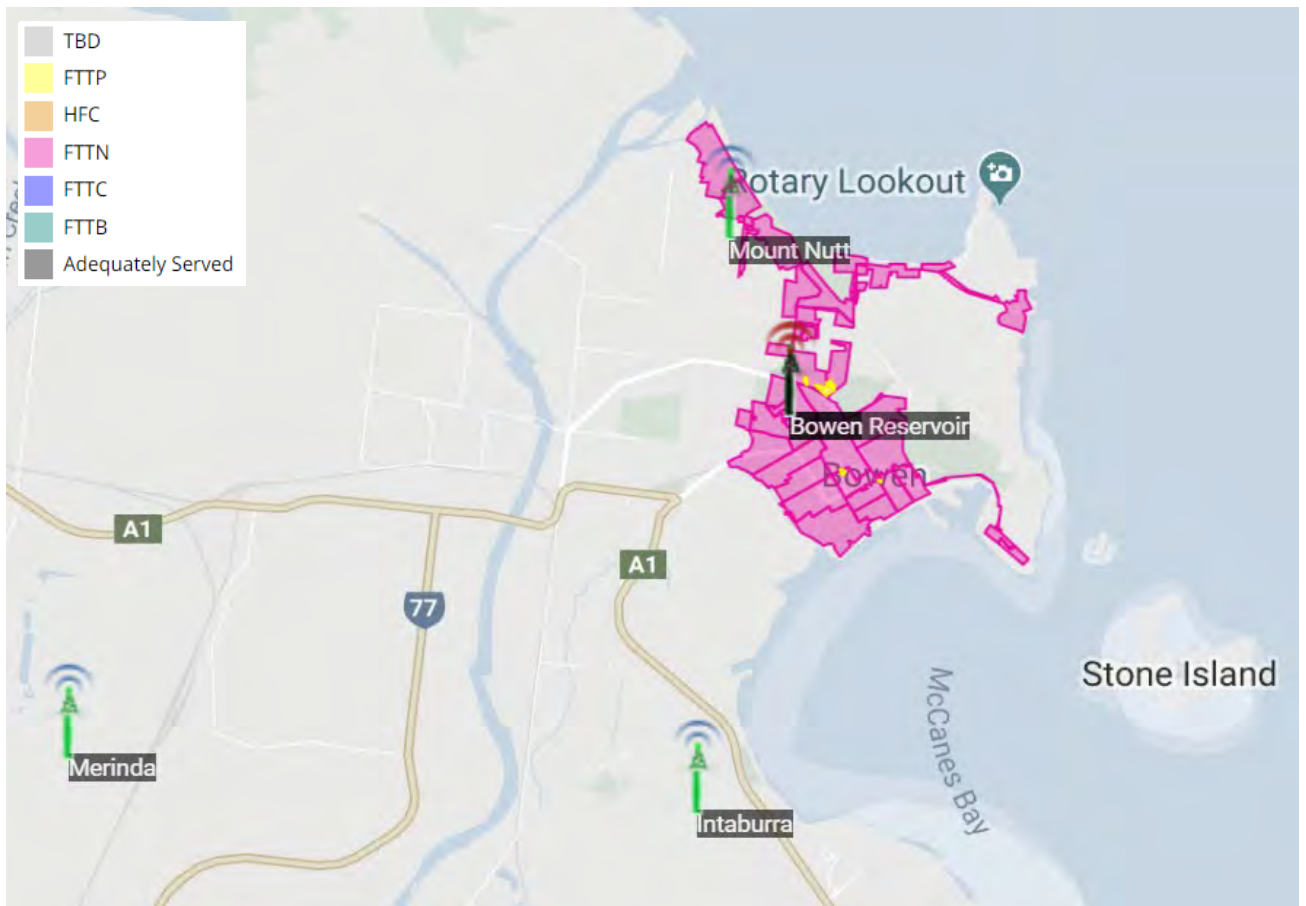


Coastal communities

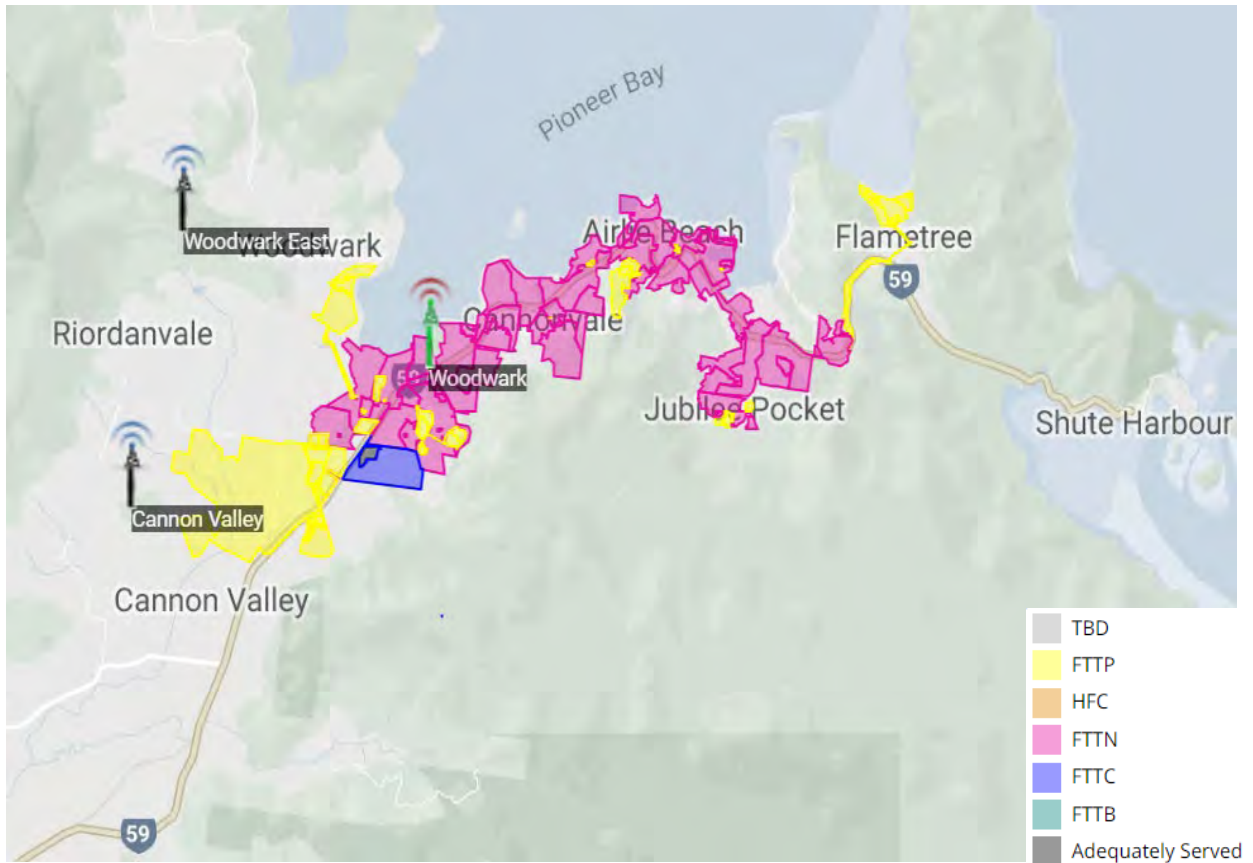


Whitsunday LGA

Bowen



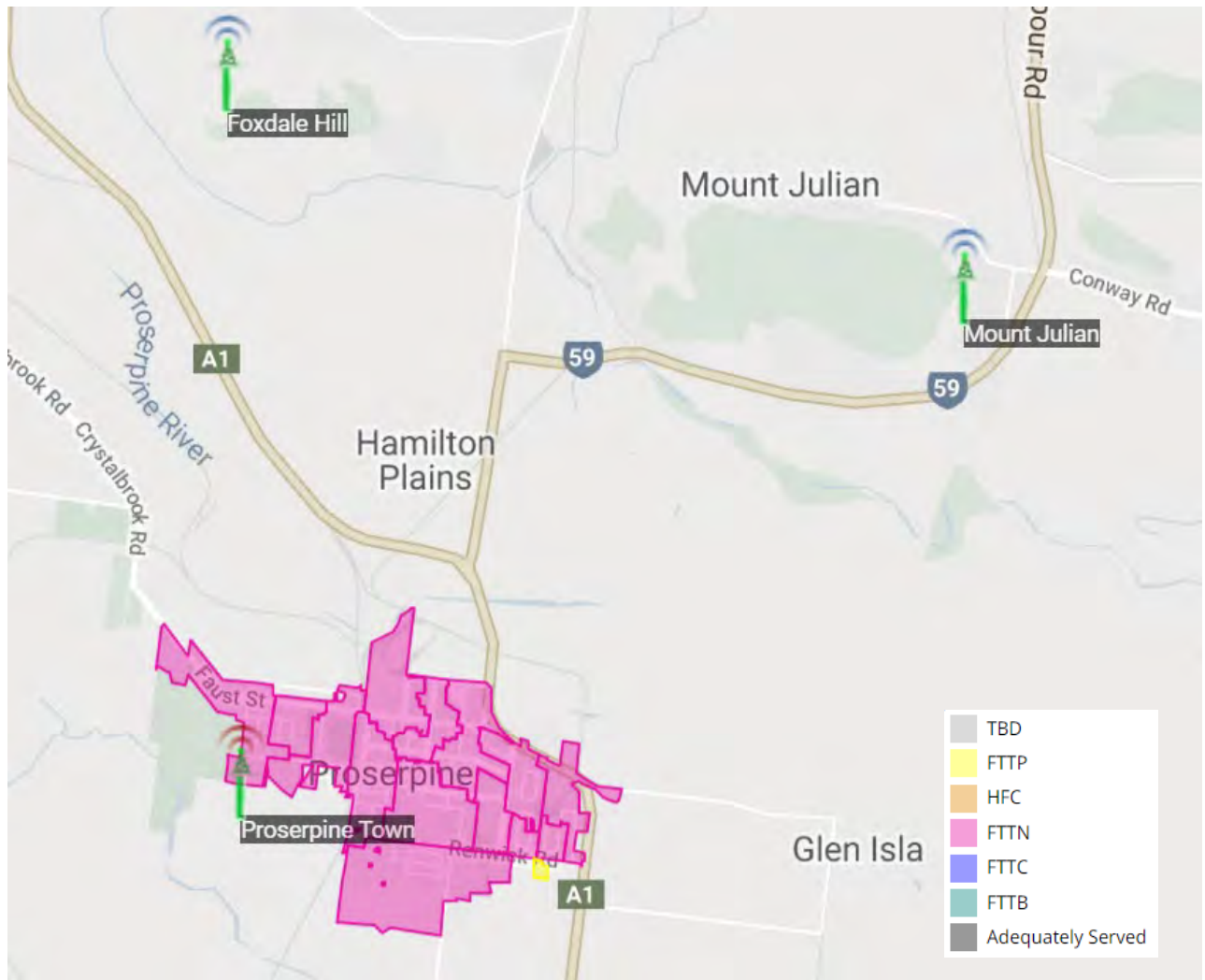
Airlie Beach & Cannonvale



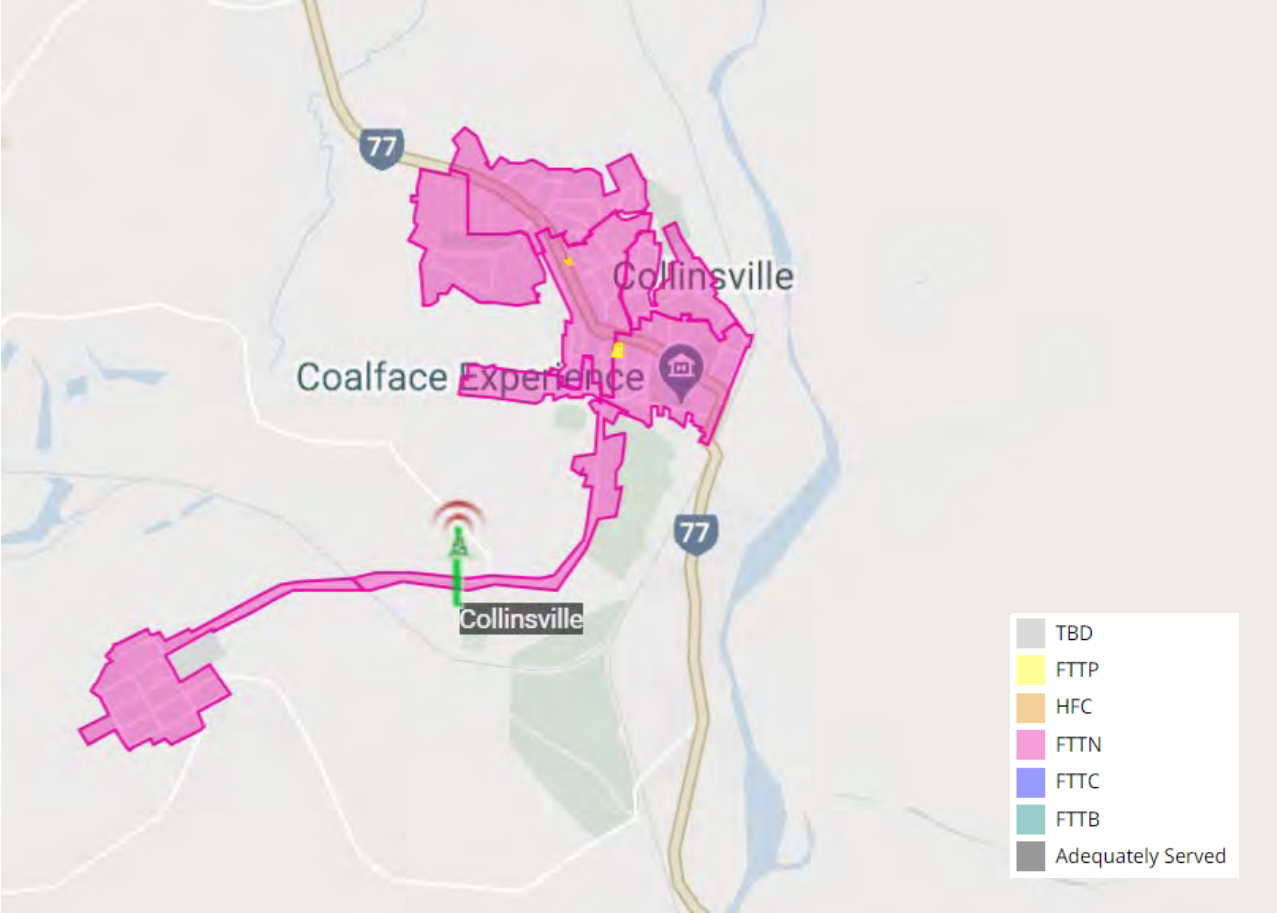
Whitsunday Islands



Proserpine



Collinsville



Appendix C

Our Digital Futures report

A young woman with black hair and bangs is looking upwards with a thoughtful expression. The background is a blurred, warm-toned scene of people in a public space, overlaid with a digital network of white lines and nodes. The overall color palette is dominated by warm yellows and oranges, with a greenish tint on the right side.

Our Digital Futures

The Digital Landscape

aurecon

*Bringing ideas
to life*

Our Digital Futures

The Digital Landscape

*'Digital' transforms
the physical - our cities,
our workplaces, our
homes, our environment,
our people, our systems,
our assets.*

It can help us solve problems and overcome challenges, be more efficient, work smarter and generate new revenue. But achieving these outcomes **now** and into the **future** heavily depends on how well you transition into, and how effectively you navigate through, this complex digital world.

Helping others make sense of the **'now'** and be **future ready** is important to us at Aurecon. So important that we set out on one of our most intensive market research journeys yet – with the ultimate destination being to help our clients understand the actions they can take to navigate the labyrinthian digital landscape of 2019 and beyond.

Unearthing digital challenges and barriers

Our research - a combination of online surveys and deep dive interviews with a wide range of professionals and specialist futurists from across the world - uncovers what 'digital' means to our clients and their businesses, revealing the major barriers and challenges in the constantly evolving digital space.


To be released over three waves as **The Digital Landscape**, **The Future of Digital** and **Your Digital Strategy**, the results of Our Digital Futures research provide key insights into the issues - and opportunities - that digitisation creates.

Identifying actionable insights

The insights shared will help our clients recognise what they can be doing now, and will answer their most pressing questions relating to digital:

- How can I improve clarity on what digital means in my business?
- What can I do to get better return on digital investment?
- I'm ready for digital ways of working, but where do I start?
- Who should own my digital strategy?
- How can data help me drive better efficiency?
- I'm not prepared for digitisation, or upcoming technologies, how can I get ready?
- How can I leverage the power of automated data collection on physical assets?
- How do I create a culture that's willing to embrace digital change?
- How is digital changing my customers, my market and my competition?

Building on the discoveries unearthed in Aurecon's **2016 Digital Futures** research, our latest insights lay an even stronger foundation for Aurecon and our clients to tackle challenges and realise the possibilities created by digital ways of working, now and into the future.



Our research reveals **major barriers and challenges** around digitisation and provides insights into **the opportunities** created by digital ways of working now and into the future.

Issues

- Digital literacy
- Iterative digital strategy
- Digital ownership
- Demonstrating return on investment
- Regulatory compliance

Opportunities

- Improve consensus/understanding of digital: ensure the definition of digital is shared within organisations.
- Asset performance: use digital to create new revenue streams and show return on digital investment. Also, introduce automated systems to collect data on the physical performance of assets.
- Organisational performance: bring focus, strategy, people, revenue together and elevate and specify responsibility for digital out of singular departments and up to the chief digital executive.
- Connecting systems: combining technology, experience, people to gain a competitive advantage (connecting disparate systems and platforms, helping them talk to each other).

The Digital Landscape

The pace of digital change is unlike anything we've witnessed before and understanding the current - and ever changing - landscape is a critical step in planning for the path ahead.

According to Aurecon's **Our Digital Futures** survey data, when it comes to the current state of play, ironically, 'digital' is exposing a lack of connectivity. Organisations are grappling with the complexities of the digital landscape, many fall short in understanding what 'digital' means and are also under pressure to demonstrate financial return on digital investment (ROI).


Nine out of 10 organisations have faced some sort of challenge in embracing 'digital', highlighting a pressing need for intervention and consultation.

Top organisational challenges (top three, % ranked #1)

 **Only 5%** have not begun to embrace digital

 **Only 4%** are yet to face any challenges

#1



"Not many of my key decision makers understand what 'going digital' actually means"

29% Decision-makers lack understanding


#2



"Because any anticipated revenue uplift is currently academic. Hence there is uncertainty around profits while focused very strongly on initial costs."

24% Need to show immediate ROI

#3



"The financial cost of moving to digital with peta-scale infrastructure is large. There are other priorities to be funded."

24% Cost

Narrow definition of digital

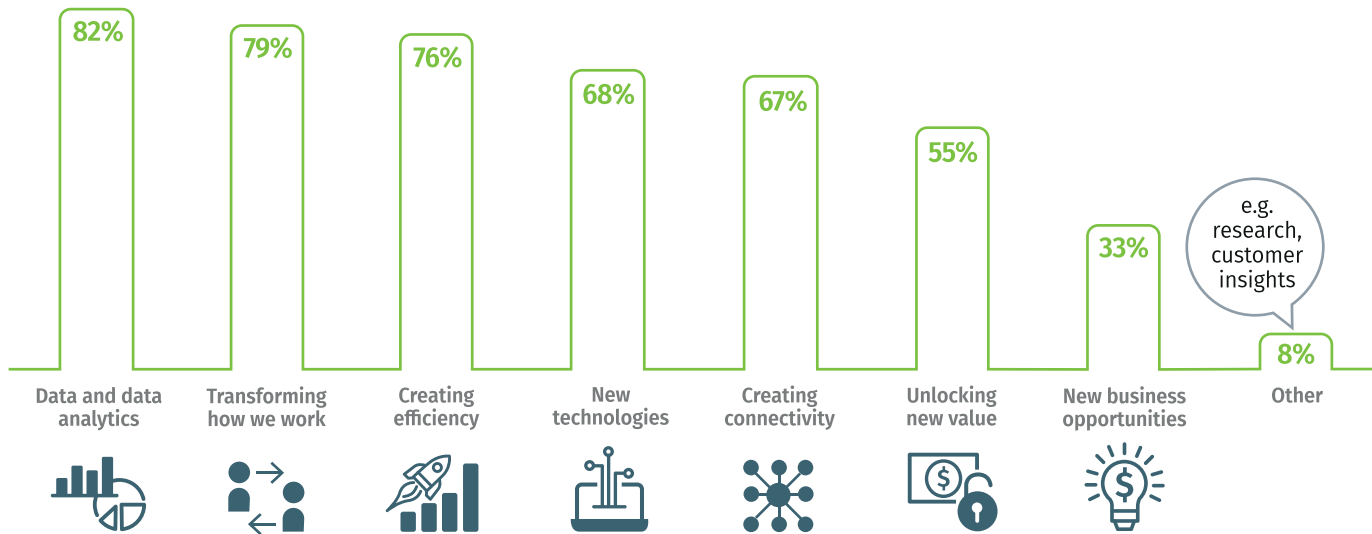
The data reveals a majority of organisations are focussed ‘internally’ on the present and see analytics and organisational factors - such as changing how businesses operate and creating efficiencies - as the starting point for their digital journey.

When asked what ‘digital’ means for your business, 82% of respondents said ‘Data and analytics’, 79% ‘Transforming how we work’ and 76% ‘Creating efficiency’. Just 33% defined digital as ‘Creating new business opportunities’.

“Insights from the depth interviews suggest this is because many organisations are still preparing their internal systems and processes to ‘plug in’ to an increasingly digital business world. Also, many organisations believe that creating efficiencies will help to prolong the life and utility of existing assets, by leveraging technologies such as internet of things and approaches such as predictive maintenance.”

Dr Andrew Maher,
Chief Digital Officer,
Aurecon

Definition of Digital



Creating revenue opportunities

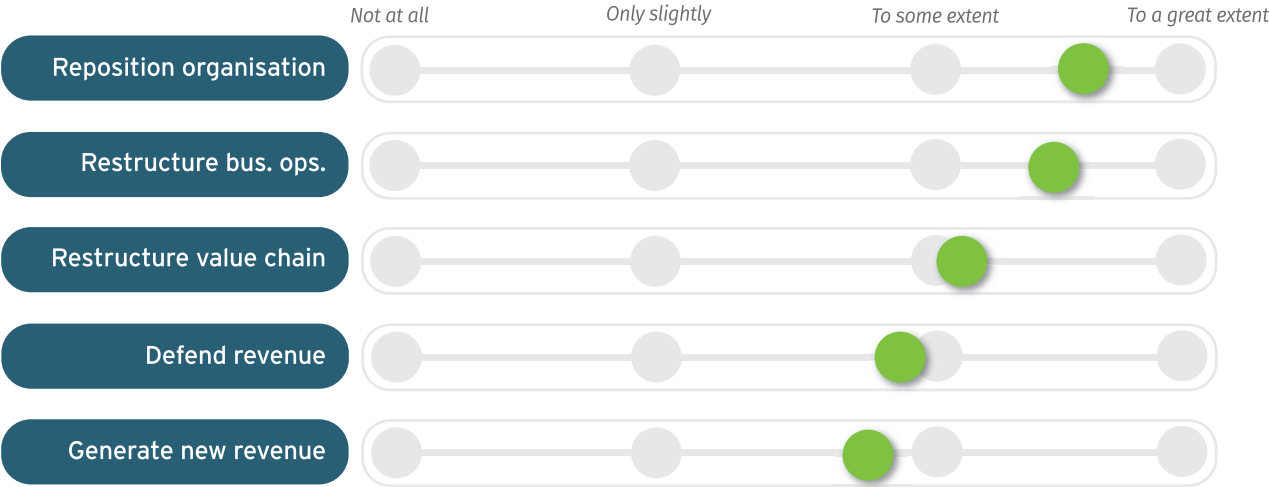
Interestingly, despite the pressure to show ROI, factors directly relating to revenue streams - such as creating new business opportunities and unlocking new value - are less salient.

Currently, physical assets don't play a major role in many of our clients' digital strategies. They don't see that digitising their assets can better support their overall business objectives and be a competitive advantage. This means those focussing only on digital ways of working to improve organisational efficiencies are missing opportunities to connect assets to business strategy, adapt and repurpose assets, and use it as a source of differentiation. Organisations who create strong business cases and invest in the right digital approaches are likely to be at less risk in terms of demonstrating future ROI.

Analytics might be a starting point for many, but there is so much more potential for business.



‘Digital’ driving core business outcomes

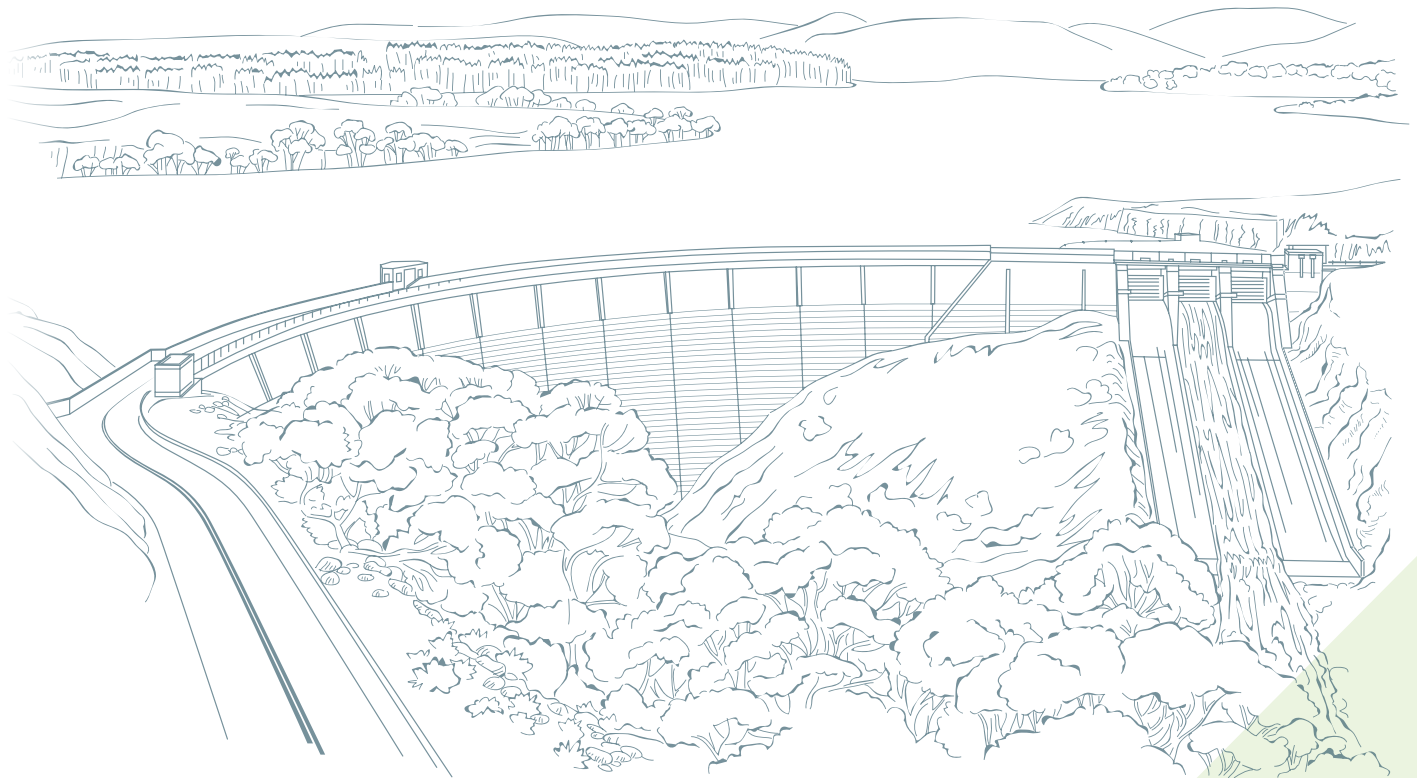


Most respondents thought digital was a vehicle to ‘Reposition an organisation’ and ‘Restructure business operations’, whereas ‘Generating new revenue’ was thought to be the least likely outcome



Case studies

A cutting edge network of IoT sensors, to be installed at **London Bridge station**, will gather a broad range of data to help prevent delays and train cancellations. Using an IoT-enabled platform for rail assets monitoring and predictive maintenance, rail operators will have immediate and clear visibility (via a 3D virtual model of the station and tracks) of information on when and where faults are likely to occur. The system will enable companies to fix a problem before it becomes one, and at a time when commuting is not disrupted.



Australia's SA Water faced challenges in identifying when and from which reservoir to transfer water across their treatment plants. With a digital strategy connecting assets, data is now being used to help make better decisions for this complex system, and to more efficiently distribute water across the state and through metropolitan Adelaide. SA Water is also in the process of using digital to regain control over one of their single largest operational expenses, by using solar and advanced analytic and optimisation tools to contribute to its goal of a zero cost energy future.

Case studies

The creation of **Sasol's Digital Office** in South Africa is uplifting their capability and driving digital through the organisation. Sasol created a dedicated digital office, a senior level digital management and digital budgets for digital initiatives to understand how the world is changing, how to leverage technology and to develop digital citizens within the organisation i.e. how to stay relevant in the world today. Sasol has changed the way they do business by understanding what their customers need so that they can develop products that sell.

Victoria's Department of Premier and Cabinet demonstrates an exemplar multi-pronged digital approach – with both an internal and external focus. The State Government application programming interface (API) shares information and data in four broad use cases: within an individual department, between departments, Government to its partners and then finally open data. The result? “It really lifts up our open data to be truly programmatic, machine readable, reusable.”

Students at the **University of Western Australia** were faced with delays of up to several weeks during the application and admission process. After the university turned to digitisation (automation) to connect assets and drive a better ‘customer experience’, they reduced the admission process to just a few days, enabled faster decisions, and realised significant business improvements in collecting and managing huge volumes of information.

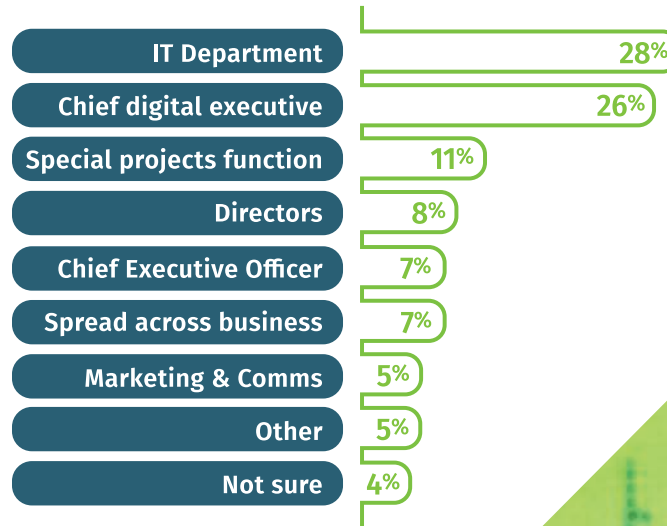
The importance of owning and understanding digital

The survey data revealed some concerning trends relating to understanding 'digital' and owning 'digital' within organisations - two factors which are critical in effectively preparing organisations to move forward in their digital journey.

Digital ownership and strategy

The research reveals that although many have begun to embrace digital ways of working, responsibility and digital ownership is disaggregated in a majority of organisations, resulting in focus being only on specific areas such as IT or systems. A lack of leadership results in limited focus on new revenue and inward facing strategies, yet where organisations employ a chief digital executive to oversee digital strategy and implementation, the opportunities to connect strategy, performance, revenue and ROI are much clearer.

Responsible for digital strategy



29% of respondents believe decision makers' lack of understanding of digital is their biggest challenge

Depth interviews suggest that a lack of ownership within businesses and ‘too many chiefs’ contributes significantly to a murky understanding of what ‘digital’ means, and ultimately reduces digital competency and value gained.

“There aren’t off the shelf solutions which you can just pick up and apply to your business. It requires a program of strategic business transformation and a dedicated full-time digital team to manage that transformation.”

Simon Vaux,
Director Digital Engineering,
Transport For NSW

“The biggest challenge is leadership and commitment and openness of the organisation to change HR processes and systems to support the digital aspiration. Sasol’s are now finding that to thrive in the digital world, one needs to develop and build in an ecosystem environment.”

Natalie Naidoo,
Chief Digital Officer, Sasol

“UWA has an extensive IT team led by the Chief Digital Information Officer, who owns the digital strategy and is responsible for persuading the rest of us that our strategy has the right components that will fundamentally improve our competitiveness and the quality of what we deliver.”

Simon Biggs,
Senior Deputy Vice Chancellor,
University of Western Australia

“Many of us are comfortable in adapting a new technology but we still tend to use the same mindset.”

Kristin Alford,
Futurist

“We were definitely at risk – we had no clear ownership, and projects were being conducted with isolated teams rather than organisation wide efforts.”

Anonymous

Defining and understanding digital

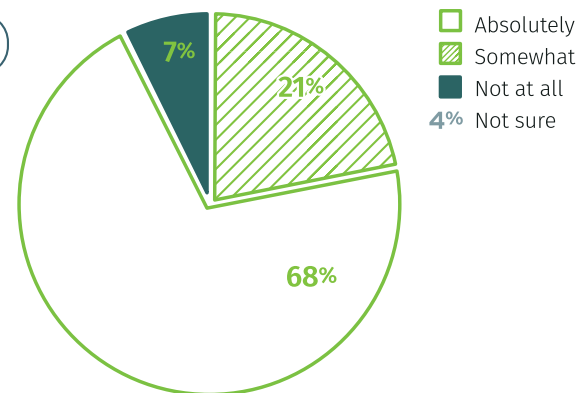
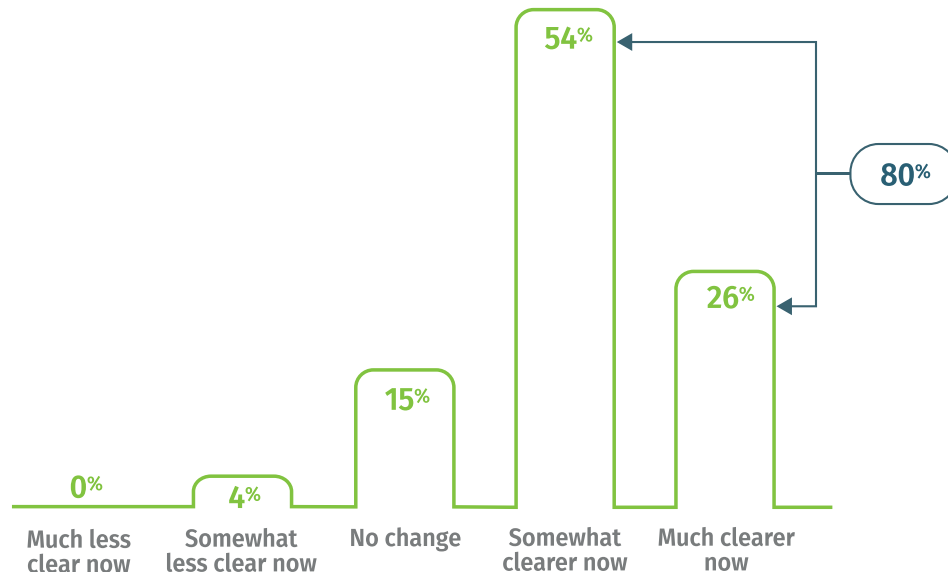
Aurecon's 2016 research revealed 'digital' was used in a variety of ways and had a multitude of different meanings. Our latest research shows that while for many organisations the definition of 'digital' has become somewhat clearer in the last few years, this clarity is not necessarily shared deep within businesses, with just 1 in 5 feeling confident that their definition is shared across their organisation.

"As an end to end property solutions provider; we have a vested interest in defining and owning the digital delivery process. It's the way we maintain accountability for the highest safety and quality outcomes on our projects."

Richard Kuppusamy
Head of Digital Integration, Asia
Lendlease


"The definition of 'digital' goes back to 'ones and zeros', though what we have done with this is re-platform our methods of communicating, storing, transacting from a physical platform into a platform of 1's and 0's. Ultimately, we're seeing the world become more and more connected."

Pete Williams,
Futurist



"To understand the meaning and the language of digital equates to digital competency."

Dr Andrew Maher,
Chief Digital Officer,
Aurecon



“The transformation opportunity that ‘digital’ brings is about a few different layers: how can you use the medium to inform; gather and disseminate information to create greater understanding, how you can use the medium in interactions and then transactions - and I don’t mean purely a financial transaction, but a transactional event. Then break this opportunity down between your consumer, your employees, your partners, your governance structures etc.”

Jithma Beneragama,
Director of Digital,
Victorian Department of
Premier and Cabinet

Case studies

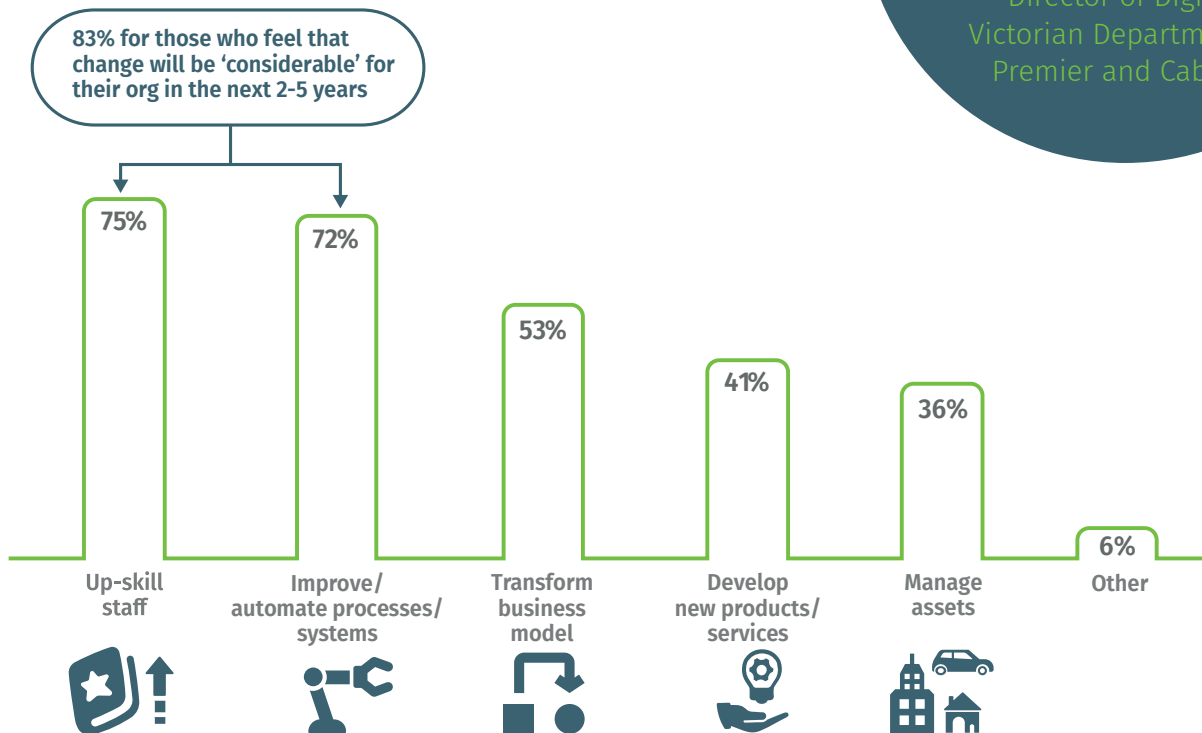
Transport for NSW observed disparate definitions and implementation of ‘digital engineering’, limiting data driven insights and opportunities for data exchange or re-use on transport projects. By leading in the development of the Digital Engineering Framework, they have transformed their business with a focus on managing data and information as an asset, ensuring that it is consistent, reliable and reusable. This long term strategy has the power to provide valuable insights, create efficiencies and enable more collaborative and productive methods of project delivery and asset management.

The world has witnessed significant major players fall by the wayside – **Kodak, Blockbuster, Nokia** to name a few. While these are complex stories of leadership, one commonality they all shared was the inability to work together as an organisation to solve challenges posed by digital disruption. Understanding digital, owning digital and making it meaningful and tangible for an organisation are all critical factors in moving from ‘at risk’ to ‘best in class’.

Digital unreadiness

While there was clear consensus that digitisation will change organisations considerably - both immediately and increasingly into the future - the majority of respondents feel their organisations are not properly prepared to thrive currently.

When considering what they need to thrive, the issue of where to start was a common theme, yet many believed up-skilling staff and automating systems were potential key areas to address now before they can move forward.



"You can't just close yourself off to new ideas and new approaches, but there needs to be some analysis before you dive in head first."

Jithma Beneragama
Director of Digital,
Victorian Department of
Premier and Cabinet

"We need to identify gaps in the digitisation journey. Understand where clients want to be, what their North Star is that they want to work toward. Then they need to understand how to fill those gaps, either with technology, with different skill sets, or a combination of both."

Yvonne Lim,
Futurist

Make sense of the now, now!

The message from the first wave of **Our Digital Futures** is clear: the digital world can be complex and challenging and many organisations aren't making the most of opportunities to grow revenue, reduce costs and risk, enhance user experience and create efficiencies.

As our clients continue to traverse an increasingly digital landscape, at Aurecon we are committed to ensuring these new insights pave the way for smart **digital ways of working** which will bring out the best in our clients' operations and their people and help them thrive in the digital present and future.



*Bringing ideas
to life*

About Aurecon

Aurecon brings ideas to life to design a better future.
Imagining what is possible, we turn problems into solutions.
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For more information please visit

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