Telecommunications Infrastructure Support Guide

Making the most of the nbn
and the Mobile Black Spot Program

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For any questions relating to this guide or the information
contained herein, please feel free to contact RDA Central West and
we will endeavour to provide assistance where possible.

About Regional Development Australia Central West

RDA Central West is a Commonwealth and State funded not-for-
profit organisation responsible for the economic development
and long term sustainability of the NSW Central West region.
Our organisation is overseen by a Committee of dedicated local
leaders who possess a wide cross section of professional skills and
experience.

RDA Central West is committed to building a stronger Central West
region. Together with regional leaders we aim to drive business
growth, new jobs, skills development and business investment
across the 11 local government areas of Bathurst, Blayney,
Cabonne, Cowra, Forbes, Lachlan, Lithgow, Oberon, Orange,
Parkes and Weddin.

Contents

List of Abbreviations

ACCAN	Australian Communications Consumer Action Network
ACMA	Australian Communications and Media Authority
FTTB	Fibre to the building
FTTN	Fibre to the node
FTTP	Fibre to the premises
HFC	Hybrid Fibre Coaxial
LGA	Local Government Area
MBSP	Mobile Black Spot Program
MNO	Mobile Network Operator
nbn	national broadband network
nbn co	national broadband network company Limited
RSP's	Retail Service Providers

Foreword

Telecommunications Infrastructure in Central West NSW, like elsewhere across Australia, is undergoing a process of transformation.

The rollout of the national broadband network (nbn) is anticipated to provide each Australian household and business premises open access and minimum service levels of broadband. Additionally, the Australian Government's Mobile Black Spot Program (MBSP) combines public-private funding to expand mobile coverage in regional mobile black spot areas.

However challenges remain in ensuring that the telecommunications infrastructure planned for the Central Western NSW region is able to meet the needs of businesses and community members now and into the future.

These challenges are compounded by projected growth of the region. Central West NSW has been identified as the sixth largest 'fast growing' and 'high potential regional hub' in Australia capable of contributing $17.4 billion GRP by 2031[1]. Infrastructure Australia has identified the need for coordinated investment in infrastructure in such regions in order to maximise potential productivity and support planned growth[2].

Investment in telecommunications infrastructure in the region is also essential in order to support the digitalisation, professionalisation and increased connectivity of the workforce across all sectors of the economy.

With this in mind, I trust that this Telecommunications Infrastructure Support Guide will be of significant interest and value to a range of Councils, business and community stakeholders across the Central West. We look forward to any comments, feedback or questions you may have and would be pleased to provide support where possible.

Alan McCormack
Chair, RDA Central West

Introduction

RDA Central West has developed this Telecommunications Infrastructure and Support Guide, providing readily accessible information in response to concerns expressed by various regional stakeholders about the MBSP and nbn rollout.

Stakeholder consultations have revealed that in many instances current broadband internet and mobile coverage is inadequate for local needs posing a hindrance to the productivity of businesses, connectivity to global markets, access to education and educational resources, delivering tele-health services and personal safety.

In 2016, there were 369 Mobile Black Spots (MBS's) in Central West NSW alone[3].

This guide aims to provide a starting point in undertaking a coordinated, regional approach to shaping telecommunications infrastructure across the region.

Further work will be required in planning and mapping where infrastructure changes will need to occur to meet community and business needs now and into the future. Ongoing input from stakeholders will also be required at a local level in order to secure investment for the benefit of the region.

This Telecommunications Infrastructure and Support Guide has been developed following consultations with Mobile Network Operators, nbn co, Councils, Central NSW Councils (Centroc), technical specialists, local businesses and community groups across the NSW Central West region.

This support guide has been developed to assist Councils, businesses and community groups in the NSW Central West region to understand;

1. How they may be affected by telecommunications infrastructure rollouts planned for the region

2. How they may contribute to the development of this infrastructure to inform and plan for local needs

Mobile Black Spot Program

Overview

The Mobile Black Spot Program (MBSP) is an Australian Government program aimed at improving mobile phone coverage and competition in regional areas through funding to Mobile Network Operators (MNO's) to invest in new or upgraded mobile towers.

The program is administered by the Australian Government Department of Communications and the Arts, and awards funding (up to 50% of initial costs) to MNO's who successfully apply, in accordance with guidelines published for each round of funding. Only MNO's and Mobile Network Infrastructure Providers are eligible to submit applications to the Federal Government's MBSP. State Governments can also choose to allocate funding towards each round of the program. To date, there have been two rounds of MBSP funding (see 'Round 1' & 'Round 2').

Mobile Coverage Program Discussion Paper

The MBSP was established in 2014, in response to the Mobile Coverage Program Discussion Paper seeking stakeholder feedback on the best way to deliver the Australian Government's initial $100 million commitment to improving mobile coverage and competition in regional areas[4]. As a result of these consultations, the MBSP was initiated and Round 1 Guidelines were released in December 2014.

Mobile Black Spot Database

A database of 'Community Reports of Poor or No Mobile Coverage' was established in 2015 in order to identify mobile black spots, as nominated by the public, that required rectification[5]. This was updated in 2016 after a second round of public nominations were received. These MBS's can also be viewed spatially on the National Map, by selecting the data set 'Mobile Black Spot Database'[6].

Round 1 — Mobile Black Spot Program

The Australian Government committed $100 million to Round 1 of the MBSP, in order to deliver 499 new and upgraded mobile base stations across Australia between 2015 and 2018. The NSW State Government made a contribution of $24 million, while Councils, businesses and community organisations across Australia contributed $1.7 million funding.

Round 1 MBSP information and Guidelines are available here: **https://www.communications.gov.au/what-we-do/phone/ mobile-services-and-coverage/mobile-black-spot-program**

This table shows the significant variation in both the number of mobile black spots and funded mobile base stations under Round 1 of the MBSP in the Central West NSW region, according to Local Government Area.

Local Government Area	No. of MBS's	No. of Towers funded under R1 MBSP
Bathurst	56	2
Blayney	16	2
Cabonne	75	5
Cowra	24	6
Forbes	20	3
Lithgow	56	4
Oberon	39	2
Orange	3	0
Parkes	31	0
Lachlan	37	1
Weddin	12	0
Regional Total:	**369**	**25**

Figure 1: Mobile black spots and R1 MBSP funded mobile base stations by LGA in Central West NSW, Australian Government Department of Communications and the Arts. Note: This does not include the MBS's that are planned to be rectified after upgrades to mobile base stations funded under R1 MBSP.

Round 2 — Mobile Black Spot Program

The Australian Government committed a further $60 million to Round 2 of the MBSP and applications from MNO's closed on 14 July 2016. The successful base stations to be funded under Round 2 MBSP are expected to be announced late 2016.

Round 2 MBSP information and Guidelines are available here: **https://www.communications.gov.au/what-we-do/phone/mobile-services-and-coverage/mobile-black-spot-program**

The MBSP Round 2 Guidelines outline the Australian Government's criteria for awarding funding to proposed mobile base station upgrades based on:

Tip 1: While the above criteria will need to be prepared by MNO's applying to the MBSP, experience from Round 1 suggests that strong input and involvement from local stakeholders has delivered successful results for communities.

MNO's have indicated that they are interested in receiving input from stakeholders to assist them in the development of these applications.

1. New coverage area (based on the size of new mobile coverage footprint area for both hand held and external antenna coverage)
2. Coverage benefits (based on the number of premises and length of major transport routes including passenger rail corridors, in the new coverage area)
3. Remoteness of location (especially remote and very remote areas)
4. Member of Parliament priority (whether it is supported as a priority location by a Federal MP)
5. Co-contributions (amount of co-contribution from MNO's, State Government and other third parties)
6. Cost to the Commonwealth
7. Service Offering (whether roaming services and/or extended auxiliary power capacity is provided).
8. Commitment of use (by other MNO's)

The Australian Consumer Communications Action Network (ACCAN) has published a comparison of the MBSP Guidelines between Rounds 1 and 2: **https://accan.org.au/hot-issues/1171-changes-to-mobile-black-spot-program-criteria-for-round-2**

Only MNO's can submit applications to the MBSP.

What can YOU do?

The MBSP is aimed at providing solutions to mobile coverage issues and increasing competition, in consultation with all relevant stakeholders.

However the first step is to establish where the mobile coverage issues are and the extent of these issues, if they have not already been identified. Some ways to do this are to:

1. **Identify where the mobile black spots are in your area.**

This can be done using the **National Map** and selecting to display data for mobile black spots **https://nationalmap.gov.au/**

/ Alternatively, mobile black spots can be searched using the **database of 'Community Reports of Poor or No Mobile Coverage'** listed at **https://data.gov.au/dataset/community-reports-of-poor-or-no-mobile-coverage** and choosing to 'add filter' accordingly.

/ The validity of these mobile black spots may need to be tested, including between providers. This can be done on the ground, or using the **Open Signal** crowd-sourced mobile coverage maps **https://opensignal.com/**

/ The Australian Communications Consumer Action Network (ACCAN) has published a **'Community Consultation Guide'** to assist communities in developing a community business case for investment **http://accan.org.au/consumer-resources/community-consultation-guide**

2. **If there are multiple mobile black spots or coverage issues, consider where the priorities are.**
   This may be along major transport routes or roads with high traffic counts, around residential developments or industrial estates, tourism hot-spots, natural-disaster or fire-prone areas, areas with safety concerns.

Did you know?

Approximate construction costs for new mobile towers can be around $500k+ (depending on access to power, access, backhaul and other MNO network costs).

This may be relevant when considering potential co-contributions.

Tip 2: Councils, businesses and community groups can contribute to the MBSP by partnering with MNO's and helping to identify sites for location of mobile base stations, as well as cash or in-kind contributions in each case.

Tip 3: The co-contributions that may be requested or required in each instance will vary depending on location; talk to MNO's about what contributions would assist in securing investment in each case (gathering all of the below doesn't necessarily guarantee investment in mobile network infrastructure).

Suggestions of co-contributions you might like to consider are provided below:

Cash Contributions

Direct cash contributions towards the cost of construction for the proposed upgrade by;

/ Committing cash contributions to MNO's, towards the cost of tower construction (in some cases requires signing an MOU to confirm this). This could done by approaching Councils, businesses or business consortiums, not-for-profit groups, community organisations or even through crowdfunding.

In-Kind Contributions

Assistance in identifying and consulting local community stakeholders about a potential site for new or upgraded mobile base stations by;

/ Forming groups of affected local stakeholders including landholders, businesses and Council representatives, and approaching MNO's. A project lead should be identified to talk through potential sites.
The most promising sites will likely include those that don't just address a cluster of potential customers but where there is good connectivity back into the MNO's network (assisted through backhaul, power, access and a suitable structure for co-location).

/ Letters of Support from local landholders to host mobile base stations may assist

Facilitating co-location on suitable sites; this includes on Public Safety Agency towers (e.g. used by the Rural Fire Service), wind turbines, nbn fixed wireless towers, water towers & others by;

/ Identifying and granting access to existing infrastructure

/ Possible sites for co-location may be identified through the National Map, using the data set for existing towers with Australian Communications and Media Authority (ACMA) Radiocommunications Licenses.

/ The suitability of tall vertical structures for co-location in each case should be discussed with MNO's.

If required, providing MNO's information about the demographics in the proposed mobile coverage area (15 km radius as a guide) by;

/ Calculating the number of residences and businesses in the proposed area; in some cases delineation between potential retail and business customers can be beneficial (including how they will use these services and/or how it may transform business operations)

/ Local Councils may be able to assist by calculating the traffic counts on roads within the proposed mobile coverage footprint

If required, outlining safety risks within the proposed mobile coverage area by;

/ Establishing whether the proposed mobile coverage footprint will be in a disaster-prone area, and any previous accidents or safety risks

/ Local Councils may be able to provide the number of traffic accidents (as provided by Roads and Maritime Services) at locations within the proposed mobile coverage footprint

Securing the necessary planning and site approvals through Local Councils and landholders.

Connecting parties to negotiate lease arrangements, between proposed site landholders and MNO's.

Local Councils may offer to undertake civil works providing access to the site if it is not already present.

Local Councils may offer to assist with coordinating power to site if it is not already present.

Case Study

Jemalong Ridge and Manna Mountain

Under Round 1 of the MBSP, Vodafone was successful in receiving funding for new mobile base stations to be located at both Manna Mountain (Lachlan Shire) and Jemalong Ridge (Forbes Shire).

Jemalong Irrigation Limited, an irrigation company supplying numerous local landholders, employed two consultants to assist in scoping sites and advocacy under the MBSP.

Other co-contributions and demonstrated support for this MBS rectification included:
/ Cash co-contribution from Jemalong Irrigation
/ Financial support from other local Jemalong businesses
/ Cash and in-kind contributions from Forbes Shire Council
/ In-kind contribution from Lachlan Shire Council

Local Member for Calare John Cobb and Local Member for Parkes Mark Coulton were also involved in the process.

Contacts — Mobile Network Operators

If you have begun gathering relevant information and are interested in discussing sites for location of mobile base stations, participating in consultations or providing co-contributions (in-kind or cash), contact the below three MNO's to discuss this further.

These contact details are relevant for Central West NSW.

Telstra
Area General Manager
TelstraNthNSW@team.telstra.com

Optus
Vin Mullins
mobileblackspotprogramme@optus.com.au

Vodafone
Tim McPhail
tim.mcphail@vodafone.com.au

RDA Central West is interested in being made aware of information and applications submitted to MNO's from within the region.

national broadband network (nbn)

Overview

The national broadband network (nbn) is Australia's new landline phone and internet network, providing minimum broadband services to every household and business. It does this by providing wholesale services to approved Retail Service Providers (RSP's), who then sell these to the public. nbn co does not sell these services directly.

The nbn will be delivered using a mix of technologies depending on location;[7]

1. **Fixed Line connections** (including Fibre to the Premises — FTTP; Fibre to the Node — FTTN; Fibre to the Building — FTTB; Hybrid Fibre Coaxial — HFC): These are planned for more densely-populated urban areas.
2. **Fixed Wireless connections:** These are planned for moderately populated areas such as small regional villages and the outskirts of larger regional centres.
3. **Sky Muster Satellite connections:** These are planned for all other areas that do not receive Fixed Line or Fixed Wireless connections, representing much of rural and regional Australia.

At each premises, only one type of nbn technology will be made available.

When and where will the nbn be available?

The rollout of the nbn began in 2010 and it is expected to be completed by 2020.

nbn rollout dates and technology types vary for each location. Expected build dates and technologies are available at the following sites, however these are only indicative and are subject to change.

Maps of the nbn rollout:

/ Finder.com: **https://www.finder.com.au/nbn-tracker/map**
/ nbn co: **http://www.nbnco.com.au/learn-about-the-nbn/rollout-map.html**

Lists of nbn rollout schedules by location:

/ Finder.com: https://www.finder.com.au/nbn-tracker/rollout/list
/ nbn co: http://www.nbnco.com.au/learn-about-the-nbn/three-year-construction-plan.html (last updated October 2015)

Check your address: this function on the nbn website can also be used to test exact locations where the technology mix changes (for example where fixed line and fixed wireless switch to satellite services). Visit: http://www.nbnco.com.au/connect-home-or-business/check-your-address.html

Rollout schedule for Central West NSW

The below table outlines the fixed line and fixed wireless nbn rollout schedule across the region (as at September 2016) however these are forecast estimates only and will be subject to change.

Local Government Area	Fixed Wireless connections	Fixed Line connections (estimated ready for service)
Bathurst	Available (some still under construction)	Unavailable — Bathurst (Q3 2017)
Blayney	Available	Unavailable — Blayney (Q3 2017)
Cabonne	Available	Available — Molong Unavailable — Canowindra (Q1 2017)
Cowra	Available	Unavailable — Cowra (Q1 2017)
Forbes	Available	Unavailable — Forbes (Q3 2017)
Lithgow	Available	Unavailable — Lithgow and surrounds, Wallerawang and Lidsdale, & Portland (Q3 2018)
Oberon	Available	Unavailable — Oberon (Q1 2018)
Orange	Available	Unavailable — Orange (Q4 2016)
Parkes	Available	Unavailable — Peak Hill (TBC) Unavailable — Parkes (Q3 2017)
Lachlan	None planned	Unavailable — Condobolin & Lake Cargelligo (Q3 2017)
Weddin	Available	Unavailable — Grenfell (Q4 2017)

Figure 2: nbn rollout schedule per LGA in Central West NSW as at September 2016, finder.com.au and nbn co.

The Sky Muster satellite has been turned on and is available for eligible homes and businesses, including throughout Central West NSW.

Eligibility can be verified and then providers selected through the nbn website: http://www.nbnco.com.au/

As at September 2016, customers are able to choose from 8 approved nbn satellite retail service providers:

/ Activ8me
/ Ant Communications
/ BorderNET
/ Clear Networks
/ Harbour ISP
/ IPSTAR
/ reachnet
/ *SkyMesh

Note: apply early to reduce reported long waiting periods for installation.

Will the planned nbn technology suit local needs?

Different technologies have different maximum broadband capacity limits, though all nbn technologies will provide the same minimum service level.

Businesses or customers with high data needs should consider the limits of different broadband technologies available and whether these can be provided for at their current location.

The following table outlines some of the nbn broadband technology limits:

nbn Technology	Limits
FTTP — Fibre to the premises	Full fixed line optic fibre broadband. Has the greatest data speed and bandwidth capacity (both download and upload) of all available nbn broadband options.
FTTN — Fibre to the node	A combination of fibre optic cable to the node (or cabinet), with the use of the existing copper network between the node and the premises. In some cases, the quality of broadband services can be affected by the quality and distance of the copper network between the node and the premises.
Fixed Wireless	Operates using line of sight vision, between a rooftop antenna at the premises and an nbn Fixed Wireless tower. Topography preventing this line of sight may disrupt services.
Sky Muster Satellite	Operates via satellite signal with speeds of up to 25Mbps download and 5Mbps upload available. Maximum download limits are capped at 150GB per month and in some cases may also be less than this depending on offers available from RSP's. Rural and regional businesses may need to consider whether this will meet their needs into the future.

Options to increase the maximum limits of some nbn technologies:

FTTN:

/ Poor internal wiring on premises with faulty outlets can at times be detected and rectified to improve the user experience at the premises.

/ Alternatively, business consortiums or residents can pay to have FTTP installed, either through a third party providers or nbn co themselves (see *'Can I change the nbn technology mix below'*).

Satellite:

Low population densities in nbn satellite-serviced areas are often cost-prohibitive for installation of fixed wireless or fixed wireless extension services through nbn co. Other options for high data users include approaching third party providers. Some can install FTTP or Fixed Wireless in lower density areas while other local providers operate over the microwave spectrum.

Did you know?

Unlike mobile phone towers, nbn Fixed Wireless towers operate using line-of-sight coverage. This means that if you can see the nbn Fixed Wireless tower (and signal strength is strong enough) you are likely to be able to receive broadband coverage. However undulating topography may prevent this.

Can I change the nbn technology mix?

Councils and Developers — may want to consider whether the planned technology mix (such as satellite) at development sites will be adequate, or if an application to nbn co for an altered technology mix (such as FTTP) will be required (for a fee). nbn co charges $600 per lot lot (for single dwelling units or SDUs), plus a backhaul contribution for new developments.

See nbn new property developments: **http://www.nbnco.com.au/develop-or-plan-with-the-nbn/new-developments.html**

Also see the Department of Communications and the Arts website for telecommunications in new developments policy: **https://www.communications.gov.au/policy/policy-listing/telecommunications-new-developments**

Businesses, residential areas and individuals — (for example in Industrial Estates outside the nbn fixed line footprint) may wish to form a business consortium and pay nbn co or a third party internet service provider to install an alternative broadband technology to meet their needs.

Did you know?

Developers can choose any carrier to service new developments with telecommunications infrastructure. For developments under 100 lots and developments outside the nbn fixed line footprint, Telstra is the infrastructure provider of last resort. In developments over 100 lots and developments within the nbn co fixed line footprint nbn co is the provider of last resort. Applications for new developments should be made well in advance to ensure timely processing and installation.

Additionally they can apply to switch the technology mix available at a single or area of premises (between around 150–350 premises). Applications to nbn co can be made online and costs vary.

See nbn Technology Choice program:
http://www1.nbnco.com.au/connect-home-or-business/technology-choice-program.html

Case Study

Cowra Airport Development

Cowra Council, as the developer of the Cowra Airport, applied online for a new property development with nbn co in order to install fibre to the premises (FTTP) fast broadband to sites within the Cowra Airport. This was approved and Cowra Council has since marketed the sites with FTTP.

See: **http://cowracouncil.com.au/index.php/accordion-2/17-media-releases/567-take-off-with-new-cowra-airport-development**

Photos: Cowra Mayor – Cr Bill West, Cowra Airport. Source: Cowra Council.

How can Councils best work with nbn co?

Councils can consult the 'Best Practice Guide for Councils when initially dealing with nbn co' from the nbn website, to help inform planning and learn from the experiences of other Local Councils during pilot nbn rollouts. The guide has been developed by the Australian Local Government Association and nbn co.

See nbn Local Government Planning: http://www.nbnco.com.au/develop-or-plan-with-the-nbn/local-government-planning.html

Additionally, efficiencies can be made where Councils or property developers inform nbn co when they plan construction works, potentially saving on pit and pipe works at the same time as road works, major constructions, utility works or rail corridor works.

Visit their Co-development Portal and submit upcoming projects here: http://www.nbnco.com.au/develop-or-plan-with-the-nbn/co-development-program.html

What if I need an alternative broadband solution?

In some cases, businesses may require a broadband solution before the nbn is planned to roll out in the local area, sometimes not for years to come.

Alternatively, the planned nbn technology may not meet the needs of customers in some areas.

There are a range of third party internet service providers who can provide competitive broadband services, depending on needs.

There are some independent local internet providers who operate using the microwave spectrum, including but not limited to the areas of Orange, Bathurst, Forbes, Parkes and surrounds.

Additionally, installation of alternative solutions to the nbn is also possible and offered by a range of companies. This includes FTTP and Fixed Wireless in brownfields and lower density regional areas, as well as the creation of municipal fibre networks owned by local governments.

Digital and telecommunications advisory services are also available to facilitate this process.

If you have found this guide useful, please let us know by emailing admin@rdacentralwest.org.au — it helps us to continue this work.

Resources

The following is a list of publicly-available information sources to assist in understanding and preparing information for input to the MBSP.

Mobile Black Spot Program (MBSP), Department of Communications and the Arts —
https://www.communications.gov.au/what-we-do/phone/mobile-services-and-coverage/mobile-black-spot-program

The National Map —
https://nationalmap.gov.au/

Data.gov.au, Community Reports of Poor or No Mobile Coverage —
https://data.gov.au/dataset/community-reports-of-poor-or-no-mobile-coverage

The ACMA Register of Radiocommunications Licenses —
http://web.acma.gov.au/pls/radcom/site_proximity.main_page (also located on the National Map)

Mapping Mobile Coverage Strength —
https://opensignal.com/ (also available as an app)

Community Consultation Guide, Australian Communications Consumer Action Network —
http://accan.org.au/consumer-resources/community-consultation-guide

The following is a list of publicly-available information sources relevant to the nbn rollout.

nbn website —
http://www.nbnco.com.au/

nbn rollout map (both existing and planned) —
http://www.finder.com.au/nbn-tracker/map

nbn rollout list (both existing and planned) —
http://www.finder.com.au/nbn-tracker/rollout/list

nbn rollout map —
https://nbnmtm.carto.com/viz/6ab38cc4-1b74-11e6-a856-0e3ff518bd15/public_map
(only some locations available)

nbn 3 year construction plan (2015–2018) —
http://www.nbnco.com.au/learn-about-the-nbn/three-year-construction-plan.html

Telecommunications in new developments, Department of Communications and the Arts —
https://www.communications.gov.au/policy/policy-listing/telecommunications-new-developments

Best Practice Guide for Councils when initially dealing with nbn co —
http://www.nbnco.com.au/content/dam/nbnco/documents/nbn-co-alga-guide.pdf

Other resources:

Technological Readiness measure, Regional Australia Institute —
http://www.regionalaustralia.org.au/home/tools-and-products/insight/insight-technological-readiness/

Internet Speed Test —
https://www.ozspeedtest.com/

ADSL Availability Map, Australian Communications Consumer Action Network —
http://accan.org.au/broadband/get-connected/adsl-underserved

1. Infrastructure Australia, 2016, 'Australian Infrastructure Plan', http://infrastructureaustralia.gov.au/policy-publications/publications/files/Australian_Infrastructure_Plan.pdf; pp. 60–61.

2. Ibid.

3. This figure is based on the number of Mobile Black Spots nominated by community members prior to the announcement of Round 1 MBSP funded mobile base stations, accessed through data.gov.au https://data.gov.au/dataset/community-reports-of-poor-or-no-mobile-coverage This figure however does not include the number of MBS's that are planned to be rectified after upgrades to mobile base stations allocated funding under Round 1 MBSP (25 in the RDA Central West NSW area).

4. Department of Communications and the Arts, 2013, Mobile Black Spot Program Discussion Paper, https://www.communications.gov.au/have-your-say/mobile-black-spot-program-discussion-paper

5. data.gov.au, 2016, Community Reports of Poor or No Mobile Coverage, https://data.gov.au/dataset/community-reports-of-poor-or-no-mobile-coverage

6. Australian Government, National Map, http://nationalmap.gov.au/

7. nbn co, The nbn Multi Technology Mix (MTM), http://www.nbnco.com.au/learn-about-the-nbn/network-technology.html