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# RESEARCH BRIEF

## State of Rural Information and Communication Technologies in Manitoba


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# A Call to Digital Action in Rural Manitoba:

The time is now for Rural Broadband in Manitoba.

The purpose of this report is to help create an understanding of the state of rural broadband in Manitoba, an essential first step to help the province's rural regions participate more effectively in the digital economy and harness digital opportunities. Publicly available data on broadband access was combined with a research and policy scan to develop an overview of rural broadband in the province along with recommendations for improving that broadband. These recommendations focus on provincial level efforts and outcomes that are needed and serve as a call to digital action in rural Manitoba.

> *"The number of internet users has more than tripled in a decade – from 1 billion in 2005 to an estimated 3.2 billion at the end of 2015."*
>
> *Internet Engineering Task Force in World Bank Group's World Development Report 2016: Digital Dividends*

> *"The world is changing and Manitoba must change with it"*
>
> *Rural Economic Development Strategy for Manitoba, 2016*


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# Summary

There are enormous potential benefits from increasing rural broadband in Manitoba[1]. High on the list of potential benefits are:

- Attracting and retaining population in rural communities,
- Enabling rural economic development through increased access to online markets and business opportunities,
- Increasing the productivity of local businesses through the adoption of digital tools such as video-conferencing/tele-working and productivity apps,
- Providing access to online primary and post-secondary educational opportunities that would not otherwise be available to rural communities,
- Increasing health system benefits from online health-services, which also would not otherwise be available to rural communities.

All of these benefits are critical for the ongoing health and continued viability of rural Manitoba communities; all of these benefits require high-speed broadband services. But there is a divide between the present Manitoba rural broadband situation and the realization of potential benefits. Rural Manitoba's current "digital divide" exists on two fronts—access and use.

The traditional strategy is to focus only on access—increasing broadband connectivity with a "build it and they will come" approach. This strategy alone will not result in wide-scale benefits for rural Manitoba and runs the risk of increasing challenges for rural communities, and as this paper will show, access to moderate broadband (minimum 1.5Mbps) is already good throughout southern Manitoba[2]. Likewise, investing in broadband use is essential for increased uptake, but focusing on use alone will not enable rural Manitoba to catch up or even keep pace with the digital transformations in urban areas, neighbouring provinces, or international peers.

**The way forward for realizing the benefits of rural broadband in Manitoba are tandem; improve access to broadband, and increase broadband use. Both must happen together.**

To achieve this, rural Manitoba will need all of its stakeholders to act to increase digital access and use. These rural stakeholders include municipalities, individuals, organizations, and businesses. Leadership will also be required from all levels of government to embrace a culture of change to become a digital society and realize the potential benefits that exist for rural Manitoba. A wide range options for action exist for all parties in pursuing the opportunities of broadband internet access and use.

## Recommendations

Actions for improving rural broadband ACCESS in Manitoba:

1. Provide incentives for Internet Service Providers to extend and enhance broadband networks that meet/exceed established broadband targets in rural Manitoba where broadband access to broadband is not meeting those targets.
2. Provide capital grants and support for rural municipalities and regions that want to develop their own broadband networks that meet/exceed established broadband targets, with a priority for areas in Manitoba experiencing market failure in broadband access.
3. Encourage rural Small to Medium Enterprise (SME) and community organization investment in broadband infrastructure and Internet presence through tax incentives/small grants.

Actions for increasing rural broadband USE in Manitoba:

1. Establish Broadband Plans at Provincial and Community levels that use Next Generation Access standards of 25 Mbps download and 3 Mbps upload as minimum broadband levels for all citizens and set further targets for rural broadband that will make rural municipalities competitive with their urban and international counterparts.
2. Develop Benchmarks and Monitoring tools to evaluate progress in broadband access, literacy and use at a municipal level.
3. Build and support the development of digital literacy across a wide spectrum of digital skills with a priority in education, labor force training and citizen engagement.
4. Ensure all levels of governments are leaders in developing local content in rural municipalities and regions and in using digital tools to engage populations in those areas.
5. Conduct research that fills in the existing knowledge gaps and increases understanding of rural broadband access and use in rural municipalities and regions.

1. The research, findings and recommendations in this report are limited to rural regions in southern and central Manitoba and does not include northern or remote regions of the province.
2. The data in this report is based on 1.5 Mbps coverage data that was publicly available; subsequent to the completion of this report, CRTC released 5 Mbps coverage data - for more information on this new coverage data and its impacts for this report, please refer to Appendix 3.

# Introduction

## The Problem

High speed Internet creates new opportunities for development in rural regions. However, to take advantage of these opportunities, Internet access and use must be improved in rural areas. To date, most rural regions in developed countries such as Canada have not kept pace with their urban neighbours in Internet access or use. Falling behind in Internet access and use reduces the availability of services in rural areas and weakens the ability of these regions to compete. Manitoba's situation is no different. Manitoba needs to increase rural Internet access and use to ensure that the province's rural regions are able to effectively access services and compete on provincial, national, and global stages.

## Causes of Current Situation

The major cause of the gap between rural broadband, when compared to its urban counterparts, is the market failure occurring in rural regions. Competitive and affordable access is the foundation for realizing the potential that broadband can bring. In many parts of rural Manitoba and Canada, the large geographic distances, low population density, and sometimes lower income makes it difficult to attract a single ISP, let alone the multiple ISPs needed to create a competitive environment. The resulting market failure in rural regions has resulted in patchy broadband access that is substantially slower and more expensive than what is available in urban areas.

In 2001, Canada's National Broadband Taskforce recognized this market challenge and recommended direct investment to ensure access and literacy across Canada. Rural regions received specific mention in recognition of the importance and opportunity that high speed internet represented. However, this strategy of direct investment was never implemented. Instead, the federal government spent more than a decade focusing on policies to stimulate private sector investment in high-cost rural areas. Additionally, these stimulus policies and investments have taken place without a national broadband plan or clear definition of targets for effective broadband. The results have been low levels of investment by the private sector, and the development of patchy, non-cohesive internet services across rural Canada.

## Effects of Current Situation

The potential socioeconomic benefits of broadband are wide-ranging and comprehensive with economic and social benefits. These benefits can be achieved with sufficient broadband access and use. Without improving both access and use, rural communities will not be able to take advantage of the opportunities that broadband can bring. Broadband is an essential tool and utility that rural communities need to be able to develop resilient economies, deliver services to their residents and engage with the wider world. The opportunity costs of continuing to underinvest in Manitoba's rural broadband access and ignoring the importance of broadband use in the province are too high.

> *"Rural broadband has been an important infrastructure for rural communities, as some see it as a means for retaining youth, connecting citizens, providing educational opportunities, and attracting new residents and businesses."*
>
> *State of Rural Canada Report, pg. 19*

# Broadband Overview

Broadband is the term used in this brief to describe the infrastructure that connects individuals and organizations to the Internet. This is an all-encompassing term that can be used to describe wired services such as DSL or Fiber connections, but it also includes wireless services such as satellites, microwave and mobile access.

## Broadband Speeds

Traditionally, broadband has been defined as a connection that is equal to or greater than 1.5 Mbps download. However, these speeds are no longer adequate to handle all of the data that is currently being accessed and shared on the Internet now. Social media and the proliferation of video streaming services are scaling up exponentially the amount of data being downloaded and uploaded on the Internet. Additionally, the amount of information shared on the web is doubling every year (Rifkin, 2014). Considering these two facts, fast and high quality access to the Internet is a requirement to fully participate in our digital society. In recognition of the higher speeds needed to participate effectively online, a new standard for broadband has been established.

**Next Generation Access is the new standard of broadband that countries are working towards - it is based on a minimum of 24 Mbps download and a fast upload speed.**

Internationally, some countries have adopted this Next Generation Access standard as the minimum threshold for broadband now. The American Federal Communications Commission (FCC) revised their broadband definition from 4 Mbps to 25 Mbps download speeds at the beginning of 2015. On the upload side, the FCC also established a 3 Mbps minimum threshold. Europe has also changed their broadband targets and in the EU's Digital Agenda, broadband targets are now set as 30Mbps down and 6 Mbps up for every citizen by 2020.

While Canada has joined other countries in setting new targets recently, our broadband targets are much lower than those being set internationally. In 2015, the Canadian Radio-television and Telecommunication Commission (CRTC, 2015) set higher targets for broadband connections with 5 Mbps download being the goal for 98% of Canadians by 2017. These targets in Canada are not sufficient to keep pace with growing data use or with the Next Generation Access international standards. To remain competitive internationally, Canada and its provinces need to adopt broadband speed targets that are comparable to the US and Europe in both rural and urban areas.

## Broadband Latency

Latency is another important factor to consider in broadband infrastructure. Latency is the delay between transmission and receipt of signal between two points (CRTC, 2015). High latency rates negatively affects the connection quality of broadband and can make the broadband unusable for certain services.

Most broadband infrastructures have comparable latency rates, with cable, DSL, wireless and FTTH typically averaging standards of 30 ms or less. Satellite broadband has much higher latency rates however, averaging 20x the latency rates of other broadband infrastructures in the 600ms range, according to FCC measurements (FCC, 2015).

## Broadband Types

The different types of infrastructure that are used to provide broadband access have specific pros and cons related to their implementation and use. The definition of each type of service, their ability to meet the Next Generation Access targets, along with their benefits and challenges, are listed in the table below:

| Infrastructure Type | Manitoba Providers | Max Speeds | Description | Benefits | Challenges |
|---|---|---|---|---|---|
| **Dial Up** | MTS is the main provider of Dial up Internet | 56 Kbps download | *This is a wireline transmission infrastructure that uses the telephone network to transmit data.* | - Typically available anywhere a telephone line is available | - Not a functional broadband speed anymore<br>- **Cannot provide NGA**[3] |
| **Digital Subscriber Line (DSL)** | MTS uses DSL as their primary infrastructure | 50 Mbps download advertised[4] | *This is a wireline transmission infrastructure that transmits data over traditional copper telephone lines.* | - Most common type of broadband connection used worldwide<br>- Can provide NGA speeds | - Speed is related to proximity to provider<br>- Cannot provide 1 Gbps speeds<br>- **Generally not available outside of cities and towns**[6] |
| **Cable Modem** | Westman Cable use this as their primary infrastructure | 60 Mbps download or more advertised | *This is a wireline service that transmits data over the coaxial cables also used to deliver television.* | - Can provide NGA speeds<br>- Available in most places cable television is available | - Speed decreases with more users<br>- Cannot provide 1 Gbps speeds<br>- **Generally not available outside of cities and towns**[6] |
| **Wireless-Fixed** | Most of Manitoba's rural independent ISPs uses this as their primary infrastructure (i.e. Netset Communications) | 24 Mbps download advertised | *This is a wireless service using radio waves to transmit data to receivers, which then use wired infrastructure to connect with the end user.* | - Can provide NGA speeds<br>- One of the most affordable infrastructures to build and roll out | - Line of sight infrastructure causes challenges in hilly/treed terrains<br>- Expensive setup and usage costs for customers<br>- Access to 1 Gbps speeds not yet available |
| **Wireless-Mobile** | MTS, Rogers and Telus are the main providers of Wireless-Mobile in rural Manitoba | 150 Mbps for 4G-LTE advertised[5] | *This is a wireless service that uses radio waves to transmit data to a receiver in a mobile phone or handheld device, directly to the user.* | - In some instances can provide NGA speeds<br>- Is the most portable broadband infrastructure | - Access to 1 Gbps speeds not yet available<br>- Very expensive data usage rates |
| **Satellite** | Xplornet uses this as their primary infrastructure for delivering broadband | 5 Mbps download | *This is a wireless services that transmits data from a satellite to a receiver in the home/business.* | - Can provide access to any geographic location<br>- Has the potential to provide NGA<br>- Useful for remote regions | - **High latency (delays)** compared to other services<br>- One of the most expensive services |

| Infrastructure Type | Manitoba Providers | Max Speeds | Description | Benefits | Challenges |
|---|---|---|---|---|---|
| **Broadband over Powerline (BPL)** | Manitoba Hydro Telecommunications (MHT) is the only provider offering this service for rural Manitoba. | 10 Mbps | *This is a wireline service that transmits broadband over existing low and medium voltage power networks.* | - Network of power lines exists in rural areas<br>- Potential direct connection with all electrical devices<br>- Has the potential to deliver NGA | - This infrastructure interferes with radio frequencies<br>- **Difficulty in reaching advertised speeds**<br>- **Generally not available outside of cities and towns**[6] |
| **Fiber to the Premise (FTTP)** | MTS, RFnow and MHT are providers offering FTTP to some communities in rural Manitoba | 100 Mbps download | *This is a wireline service that uses fiber optic cables and transmits the data as light over the fiber optic cables directly to a home or business.* | - Data speeds do not degrade with distance or number of users<br>- Provides NGA<br>- Can provide 1 Gbps and higher access | - **Generally not available outside of cities and towns**[6] |

3. NGA = Next Generation Access
4. Where available in rural areas, speeds are often less than 10 Mbps. MTS (2015) High Speed Internet Plans in Rural Manitoba. MTS Community Webpage. https://community.mts.ca/mts/topics/high-speed-internet-plans-in-rural-manitoba.
5. Typical wireless mobile experience is currently 17-20 Mbps. OpenSignal (2016). State of Mobile Network: Canada. http://opensignal.com/reports/2016/01/canada/state-of-the-mobile-networked.
6. CRTC's new data (April 2016) on 5 Mbps coverage supports this - for more information please refer to Appendix 3.

## IN ADDITION TO DELIVERING SUPERIOR BROADBAND QUALITY AND FUTURE PROOFING, FTTP HAS ALSO BEEN DEMONSTRATED TO BE AN ECONOMICALLY VIABLE OPTION:

- The Stokab Fiber network in Stockholm, Sweden demonstrates the long term benefits of a fiber infrastructure and cites a minimum return on investment more than 3x the cost of implementation in the network's 20 year history.
- In northern England, the B4RN community driven initiative provides a model for rolling out affordable fiber to rural homes and small communities for a fraction of the cost of large telecom projects.
- In Olds, Alberta, a locally initiated fiber project, O-Net, created Canada's fastest Internet in a town with 8,000 people and is now providing triple-play services (Internet, phone and cable) to Olds and neighbouring communities with 1 Gbps Internet speeds.

**Fiber to the Premise provides the best broadband connection currently available and is the only infrastructure that can already meet foreseeable future data needs.**

## Broadband Usage

Infrastructure is essential for access to broadband, but access alone is not the focus of policies and development in rural communities; it is the benefits of using that broadband that is most important. Only once broadband is being used effectively will rural residents and businesses realize the positive impacts of that broadband. Unfortunately, research shows that broadband access does not directly lead to broadband use and the "build it and they will come" approach to rural broadband falls short of realizing the potential of rural broadband (Ma & Huang, 2015).

The potential benefits of using broadband range from enabling economic development and delivering previously unavailable social services to offering new forms of community engagement. Economically, one of the benefits identified by research is that communities experience greater household income growth and reduced unemployment when more than 60% of households have and use broadband (Whitacre et al., 2014). Delivery of telehealth and online education are two examples of social benefits while the use of social media and website to engage and inform citizens is another potential benefit for communities.

This wide range of benefits relies on users having both access and skills to use broadband effectively. It is also essential to build a culture of use in rural municipalities in order to encourage citizens, businesses and governments to take advantage of the opportunities presenting themselves online. Access cannot be the only piece of the puzzle that is focused on as both digital literacy and a culture of use are critical parts of rural broadband as well.

**Without digital literacy and a culture of use, rural communities will be unable to take effective advantage of broadband access.**

There is a serious shortage of research and knowledge about broadband use in rural Manitoba. While there are examples of rural broadband innovation across the province, it is not clear how effectively rural broadband is being used or what the challenges are in preventing wider scale use. One of the challenges surrounding broadband is that its use is not predictable and its impact can often only be measured after the fact (Lehr, 2005). Ongoing research is needed at the local level to understand how broadband is actually being used in rural Manitoba and what opportunities and barriers exist for that use. Working with rural citizens and businesses to determine how broadband can improve their situation and provide new opportunities will be an essential action moving forward.

The digital divide does not only exist for access between urban and rural, but it also exists for the uptake of broadband and other information and communication technology. How rural communities harness the potential of broadband will dictate the extent that they benefit from that infrastructure.

## International Context

Recognizing that the rural-urban digital divide is growing, countries around the world are making rural Internet an essential pillar of their national broadband plans and rural development initiatives. The Organisation for Economic Co-operation and Development (OECD)'s 2011 report on broadband and national strategies has identified increasing broadband speeds, access, and use as important economic drivers in these national plans, and that other countries are setting specific targets and investments for rural broadband.

Establishing a broadband plan with specific and measurable targets is an essential stage in effective delivery of that broadband. Most OECD countries have developed National Broadband Plans, with Canada being one of the few remaining countries without a comprehensive strategy. These National Broadband Plans signify a clear commitment to the development of broadband for their citizens and the pursuit of a digital society. As indicated, the provision of rural broadband is also an essential element in most National Broadband plans.

The targets being set by other developed countries establish a useful benchmark for Canada to ascribe to. The broadband standards being set by both the EU and the FCC are an important reflection of the global understanding that today's broadband needs are much higher than 15 years ago when most countries had targets of 1.5 Mbps. The minimum requirements in Canada's neighbour and trading partners start at 24 Mbps, a substantial increase from the 5 Mbps set here in Canada.

*NATIONAL CONTEXT*

*"In the absence of government direction, the Canadian Radio-television and Telecommunications Commission (CRTC), Canada's telecommunications regulator, has defined aspirational minimum service quality targets, stating that speeds of 5 Mbps (download) and 1 Mbps (upload) should be available to all Canadians by the end of 2015."*

*Rajabiun & Middleton, 2013*

*NATIONAL CONTEXT*

*"Currently, 2 million rural households across Canada are under-served with broadband."*

*Ashton & Girard, 2013*

In contrast to most OECD countries Canada does not have a comprehensive national broadband strategy, nor ambitious national targets for broadband. While the federal government of Canada released a policy document entitled "Digital Canada 150", it was more focused on celebrating Canada's success in the digital society than establishing a strategy for improving it. Additionally, the document identified 5 Mbps access as the target for most Canadians, with 3 Mbps as the target for those living in northern and remote communities.

For the past decade, the Canadian government has relied primarily on market forces to provide Internet services in rural areas. This has led to a lack of investment in rural and remote areas where market forces are weak. The lack of a national plan resulted in uncoordinated and ineffective efforts on developing a critical national infrastructure.

Canada has taken several steps to bring broadband to rural and northern areas, where market forces have failed. Relaxation of foreign investment restrictions in 2012 was designed to help new providers raise funds, though this step has likely had little impact. Additionally, the federal government has provided a series of programs to subsidize capital investment in rural and northern broadband initiatives. These programs include the Broadband for Rural and Northern Development (BRAND) program, the National Satellite Initiative (NSI), the Connecting Rural Canadians program, and various efforts using the Canadian Strategic Infrastructure Fund. Between 2002 and 2013 these subsidies provided nearly $1 billion for broadband capital investment to private firms. (Rajabiun et al., 2013, pp 8-13).

There have been problems with these efforts however. These programs have typically required matching funds from provincial or sub governments, and have focused on unserved areas, rather than underserved areas. Funding has resulted in public money subsidizing large telecom firms; and the use of infrastructure transfer funds have gone mostly to the Atlantic Provinces, the North, and Quebec. Rajabiun et al. observe that other Canadian provinces have been left to develop their own initiatives to ensure the access to broadband in rural and remote areas.

*"A thriving Canada needs a thriving rural Canada and for that we need federal leadership. That means predictable and expanded funding for rural infrastructure and the ability to recognize rural communities' unique needs and opportunities. For many that starts with attracting skilled young people and newcomers through investments in housing, broadband networks and newcomer services."*

*FCM Federal Budget Submission 2016, pg. 16*

*PROVINCIAL INITIATIVES*

*"Canadian provinces are primarily responsible for delivering social and business infrastructure."*

*Rajabiun et al., 2013*

Because of the lack of national planning and insufficient initiatives, it will be up to the provinces to provide the critical infrastructure for broadband services. Several provinces have begun to do so, and initial efforts have begun to show the strengths and weaknesses of different strategies. However, the strategies available to provinces are few. These can be grouped into four strategies: *1) provide incentives to ISPs to extend network; 2) provide grants for investment in capital costs; 3) create new ISPs; and 4) create partnerships to extend networks.*

**Strategy 1:** Provide Incentives to ISPs to Extend Network

Both Alberta and British Columbia have attempted to expand their broadband network coverage through the use of incentives to ISPs. Alberta's initiative, the SuperNet, is a top-down public sector initiative to connect 95% of rural communities in Alberta with a minimum of 10Mbps service (Ashton et al., 2013, p. 68). As part of this initiative the provincial government also committed to purchasing information services from SuperNet. Here, the Alberta provincial government has paid to upgrade the high-capacity network 'backbone' of broadband, which is usually considered an efficient strategy because of the possibility of connecting many people. The challenge for Alberta, as with all 'backbone strategies', was accessing last mile infrastructure. The province has had to provide two additional programs to cover this last mile. This has proven costly.

British Columbia used its buying power to encourage upgrades to the network by ISPs and to provide points of presence (POPs) in 120 communities. The government entered into long-term contracts with local operators to provide these services. British Columbia also created a grants program that worked with local firms and community organizations to resolve last mile connectivity. These grants were seen as more economical (Rajabiun et al., 2013, p. 15).

The 'last mile' challenge is the heart of the problem of providing rural broadband and reveals the market failure. Public subsides for this last mile will be required to overcome the market challenge (Rajabiun et al., 2013, p. 14).

**Strategy 2:** Grants for Capital Costs of Rural Broadband

Programs like the **Rural Connections Broadband Program** in Ontario are designed to cover capital costs of rural broadband services in partnerships with private providers. The Rural Connections program covers one-third the costs of broadband projects. Costs for this program have been carefully detailed and show that "the fixed costs of extending basic broadband access to rural communities tend to decline quickly as the size of the targeted community grows" (Rajabiun et al., 2013, p. 17). The average cost per connection was about $750.

This kind of granting program has also been run at the federal level, though at much higher costs.

**Strategy 3:** Create New ISPs

The creation of new ISPs through the efforts of government can result in extending the existing network. Ashton and Girard cite both Manitoba Hydro Telecom (MHT) and the creation of both NetSet and BCN through the actions of the Federal government's Action Plan as such examples (Ashton et al., 2013, p. 68).

**Strategy 4:** Multi-stakeholder Partnerships

Partnerships between communities, public and private sectors are also an emerging strategy. Partnerships bring together government funding experience, with ISP technical expertise, with local knowledge and infrastructure. This shares risks while guaranteeing results for communities and profits to the private sector: "[These] partnerships can overcome technological, financial, and user demand" (Ashton et al., 2013, p. 64).

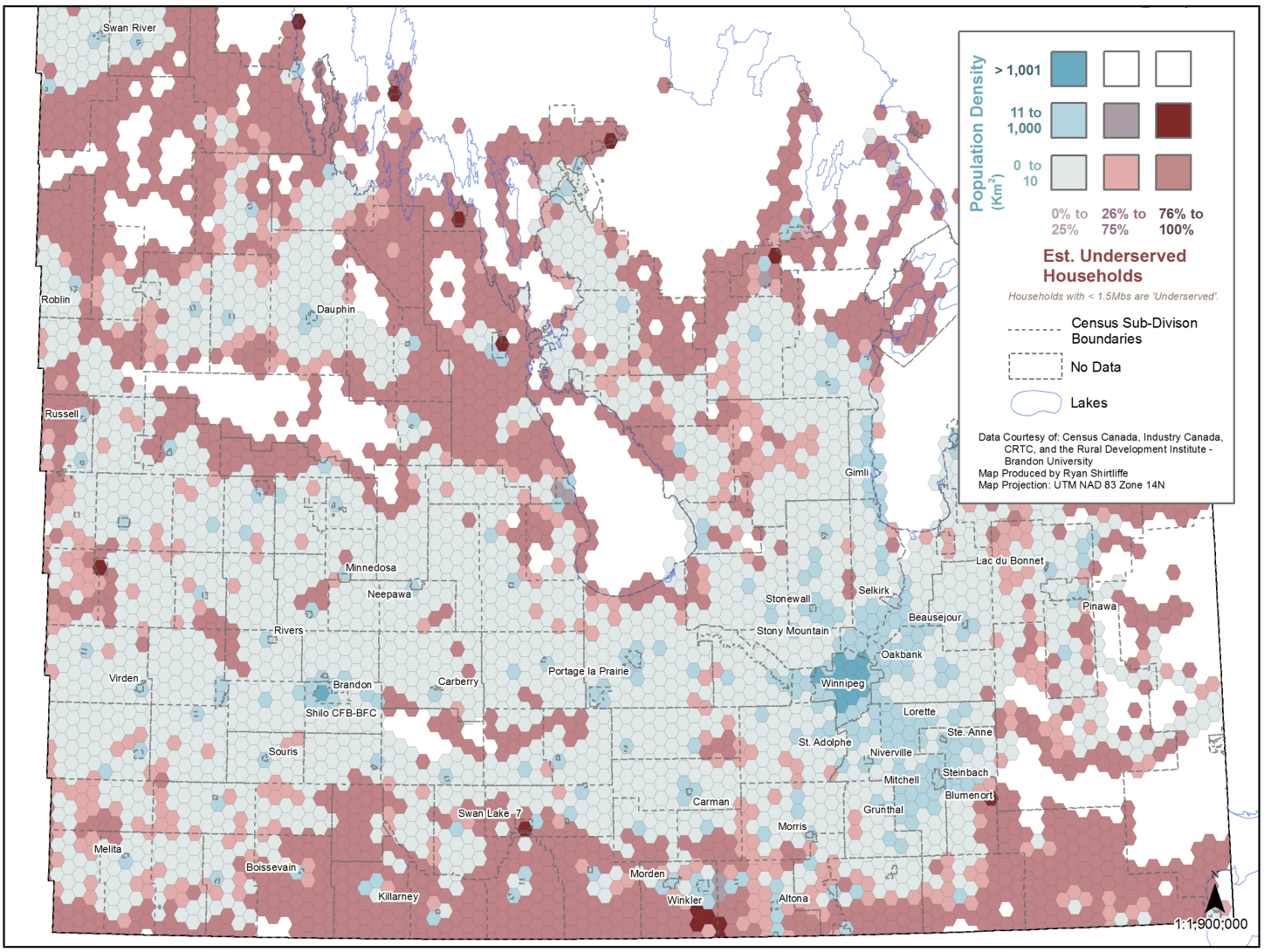
## Manitoba Situation

The Government of Manitoba has neither a broadband strategy nor targets for broadband. Nevertheless, much progress has been made in the province with most of the population having access to basic broadband of 1.5Mbps download speed. This does not meet current needs or Next Generation Access of 24 Mbps.

In the appended figures and below, information about this broadband access in Manitoba has been mapped. Underserved households (those not receiving at least 1.5Mbps) has been compared to population density at three geographic levels: standard hexagonal, then amalgamated to Census Sub-Divisions (CSDs) and Self-Contained Labour Areas (SLAs). Additionally, access has been mapped in relation to income levels and education levels.

**Map 1** shows estimated Underserved Households in southern Manitoba by population density and is mapped to standard hexagonal geography. The map is coloured using a bivariate grid where increasing levels of blue indicate higher population density, and increasing levels of red indicate higher numbers of households underserved. The map shows that for areas of high density—greater than 1,000 people per km2—there are no areas with more than 25% of households underserved. This should be of no surprise—higher population areas are better served by market forces. The map also shows that the majority of southern Manitoba has access to at least 1.5 Mbps service. There are also large fringe areas of low population where more than 75% of households are underserved (shown as medium red). These run along the American border and dominate areas north of Riding Mountain National Park. There are also a few isolated locations of medium density that are very underserved shown as dark red. Notable among these is a clump of poorly served hexes south of Winkler.

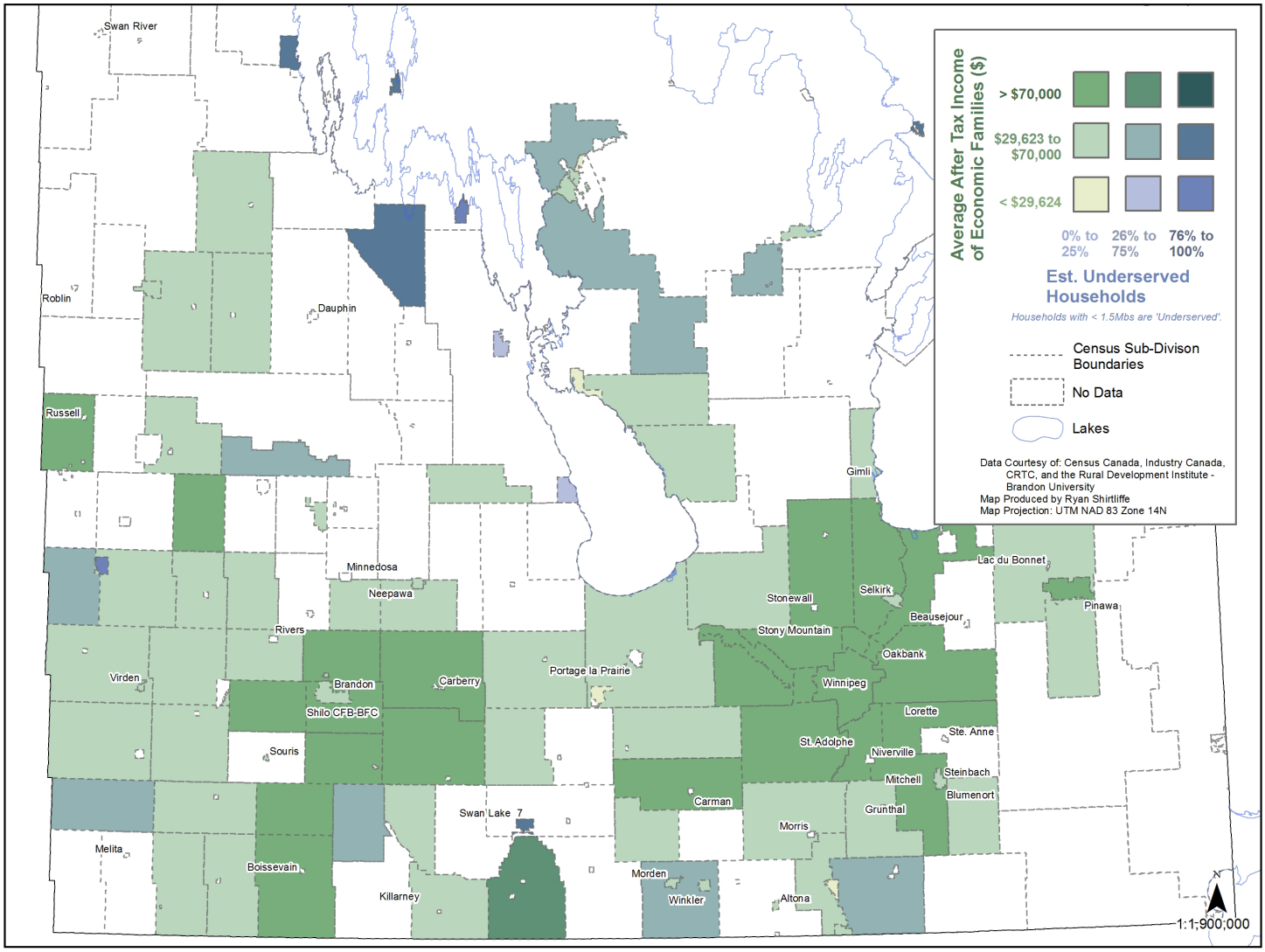
Map 1: Estimated Underserved Households (%) vs. Population Density (km$^2$) by Hex Data



**Maps 2 and 3** show the same information—Underserved Households in southern Manitoba by population density—amalgamated up to Census Sub-Divisions (CSDs) and Self-Contained Labour Areas (SLAs). These maps show similar information to Map 1. Note that Map 2 shows poor service in areas of low population density—along the American border, in Eastman close to the parks, and Riding Mountain and north. There are very few areas of high population density and very poor service. Map 3, which compares population to SLAs, mirrors this pattern.

**Map 4** compares underserved households to the after-tax incomes of families. Winnipeg and its environs, as well as Brandon and its surrounding area stand out as higher income and well served. There are no areas in southern Manitoba classified as high income that are poorly served. A few areas of moderate income are poorly served. One of these is Swan Lake First Nation, which has both medium density and medium income but is very poorly served, which is visible on Map 1 and 2. Lastly, it should be noted that many CSDs on this map are white—this indicates that the 2011 National Household Survey received insufficient data from that CSD for results to be released (e.g. No Data or Suppressed Data).

Map 4: Estimated Underserved Households (%) vs. Average After Tax Income of Families by Census Subdivision (CSD)



**Map 5** compares underserved households to education level. The pattern again replicates previous maps, with a few interesting areas of very high education levels. Note that both Riding Mountain National Park and Hecla Island have both very high levels of education and very poor service. This is a function of the very low permanent populations in those parks.

The maps in this report and the analysis included here provide a foundation for understanding rural Manitoba's rural broadband trends. The findings include important comparisons of broadband access at 1.5 Mbps with population density, income and education levels.

Additional research and analysis is needed to create a more complete picture of rural broadband in Manitoba and the socio-economic patterns related to broadband access. One opportunity for further analysis includes collaboration with Manitoba's Internet and cellular service providers to map additional tiers/speeds of broadband access using data not currently available to the public. Examining relationships between agriculture production and industry sectors with broadband access at different speeds could provide insights into the digitization of economic development in rural Manitoba for example.

Expanding the scope of the research is another important opportunity and potential research outcome for the next phase. Incorporating northern, remote and First Nations communities into the mapping and analysis for the next phase would provide a comprehensive picture of Manitoba's broadband access outside of Winnipeg. Understanding broadband access trends and patterns across all of Manitoba is an essential step in improving that access for all of the different regions.

## Policy Implications

What do these maps tell us? The generally high coverage of basic broadband service (1.5Mbps) indicated that there are very few or no spots left of high opportunity—most people in Manitoba have moderate service. Only areas of low population density remain underserved. Improvements to access will therefore be increasingly challenging—and expensive, as likely large areas of the province need access to a much faster broadband standard and the infrastructure that this implies.

The data from Industry Canada and the CRTC show that DSL and cable services are not providing anything near Next Generation Access for most rural areas. Fixed wireless is better positioned to meet current needs in rural areas. In March 2016, Netset announced that it will be providing LTE access to its customers in rural Manitoba. The advertised speeds for this service approach Next Generation Access targets with 24 Mbps download and 1.5 Mbps upload speeds. An important consideration is that these new speeds being offered in rural Manitoba barely meet the recommended minimum broadband speeds and the ability of fixed wireless to address future data demand will need to be examined.

The other challenge for wireless broadband service is cost. NetSet's rates (fixed wireless) for the above offering in rural areas is $149.95 per month, more than 2 times higher than consumers pay in Winnipeg or Brandon for a similar service. In addition, fixed wireless customers face high installation fees, in the neighbourhood of $400, for the installation of a small tower and dish required to connect homes and businesses to the broadband towers. It will be important to determine how substantial a barrier is cost for rural residents and businesses in the adoption of broadband.

**A different strategy is required that takes into consideration broadband access that addresses both current and future needs.**

Based on the comparison of broadband infrastructures, fiber connectivity directly to the premise (FTTP) is the ideal broadband connection as it enables the best download and upload speeds and is considered the most 'future proof' of the connections.

Future proofing is the ability of the broadband infrastructure to meet future demands, 1 Gbps is often cited as the next tier in usage and demand. Ensuring that access is future proofed is an important consideration in the development of broadband infrastructure–even though may cost more initially, a future-proof infrastructure such as FTTP will not require replacement as data demands continue to increase. With the ever increasing growth of data use and Internet use, FTTP is the best infrastructure for meeting both current and future needs.

Without a province-wide fiber network in place, improving rural broadband access may be best served by multiple approaches.

**Manitoba's current broadband environment will require multiple approaches to deliver Next Generation Access and beyond to rural Manitobans.**

Continuing to support and engage with ISPs that are successfully delivering broadband at Next Generation Access levels to rural regions will be essential for ongoing improvement of broadband access in those regions. Additionally, it will be critical to provide support for the development of municipal or regional broadband networks in rural Manitoba that will provide future-proofed, ideally FTTP, service to rural residents and businesses. Priority for these municipal or regionally-developed future-proofed networks should be given to those areas that are currently unserved or underserved in regards to Next Generation Access speed, which at this point includes much of rural Manitoba outside of large towns and cities.

Broadband use needs to be a focus of research and investment going forward. Harnessing the potential of connectivity already in place and ensuring that rural citizens and businesses are ready for the opportunities that increased speeds bring will be key to ensuring that the benefits of rural broadband are realized. Increasing use, through education or training for instance, may be more cost effective moving forward than the high-infrastructure costs of improving access. Creating a digital rural Manitoba depends on digital literacy and a culture of use. Investing in the digital skills and culture of Manitoba's rural citizens and businesses is essential. While some digital skills and characteristics will be universal, the specific needs, assets and goals of rural municipalities and regions will need to be identified to ensure that the correct digital skills and culture are being established.

**Investing in Manitoba's digital literacy and use is as important for the province's rural broadband as investing in pipes and towers.**

One of the key findings from this examination of the state of Manitoba's rural broadband is the need for additional research and knowledge about rural broadband in Manitoba, both on access and the use. Regarding broadband access, more data is needed regarding the type and speeds of rural broadband offered in Manitoba; this will require a lengthier research process and engagement with large and independent providers across the province. It is necessary to establish a complete picture of current and future rural broadband access. For broadband use, it will be essential to identify the current trends and barriers for broadband adoption in rural areas and to identify how broadband can most effectively meet the needs of those areas. Finally, this initiative focused on establishing a baseline or foundation for rural regions of Manitoba and was not able to include First Nation or northern communities. For a complete understanding of broadband in Manitoba outside of urban areas, both First Nation and northern communities will need to be included within the scope of future research.

**This report is an important step in building understanding the state of rural ICT in Manitoba. It was only the first step however, and more research is needed to increase knowledge and fill in data gaps about broadband access and use across all of Manitoba.**

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# Appendix 1. Methods

## Limitations

The research in this project focused on establishing a baseline for access in rural Manitoba. To this end, publicly accessible broadband data was used and analyzed based on the methods identified below. This project did not include proprietary data from Internet Service Providers in this round of research, which limited data available on the type and speed of broadband infrastructure. The research team acknowledges that the proprietary data from (Interent Service Providers) ISPs regarding broadband types and speeds will be an essential part of the research going forward. Geographically, this project focused on rural Manitoba and did not include broadband coverage for all First Nations communities or for northern communities. To establish a comprehensive state of broadband in Manitoba outside of urban areas, all First Nations and northern regions will need to be included in future research.

## Data and Mapping

Data was collected from various sources for this project. The base hexagonal geography was received from Function Four Ltd. and the Rural Development Institute (RDI) at Brandon University. The hexagonal geography consists of hexagons covering the surface of Canada, each representing a 25km2 area. This data was limited to the province of Manitoba, and each hexagon was assigned attribute data, also received from Function Four Ltd. Attributed data contained population data derived from Statistics Canada, 2011; an estimated number of underserved households, and total number of households in the underserved areas, derived from ISP coverage information compiled by the CRTC and Industry Canada.

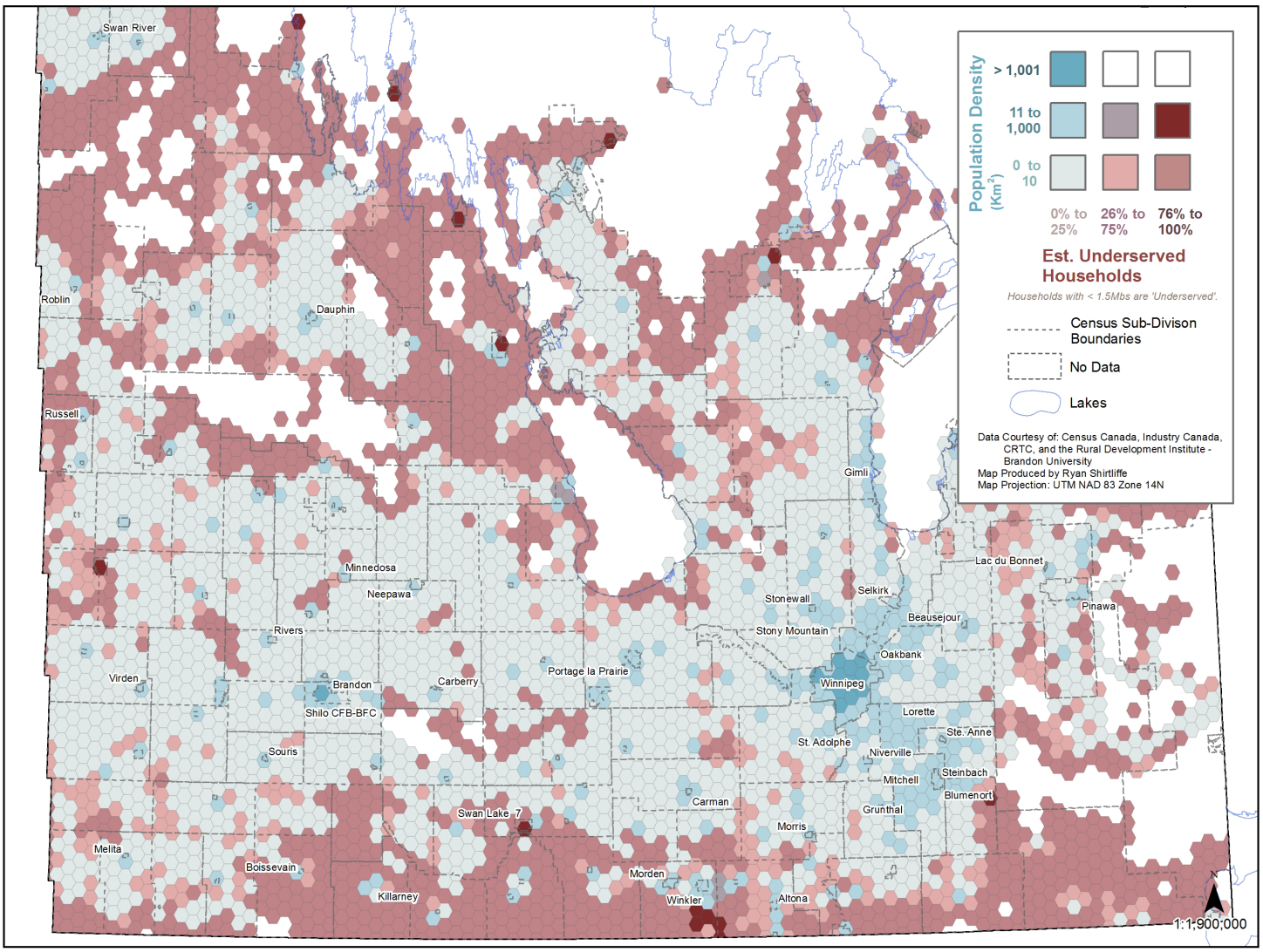
The estimated underserved household proportion was generated by normalizing estimated number of underserved households to the total number of households in the underserved areas. This proportion shows how well households in an area are served, from completely served (0%) to no service (100%). Additional data collected includes average after tax income for economic families, and education data showing proportion of the population with a certificate, diploma or degree. Both were obtained from Statistics Canada National Household Survey (2006, 2011). Self-contained Labour Areas (SLAs) data was provided by the RDI.

A methodology from Stevens (JoshuaStevens.net, accessed 2016) was utilized to create a bivariate map design; this design allowed two variables to be displayed and show correlation between them. Data was then broken into three classes for the bivariate mapping style, low, medium, and high. The primary variable, estimated underserved household proportion was classified as low to show the best served areas (0 to 25% underserved) and the most underserved areas as high (75 to 100% underserved). Population density data was classified to show large population centers (>1,001 people/km2) as high, other population centers (11 to 1,000 people/km2) as medium, and sparsely populated areas (<10 people/km2) as low. Average after tax income of economic families was classified using the low income cut-off (Statistics Canada, 2011) for a 2010 for a family of four for the low average income class (< $29,624). The high average income bracket was chosen at >$70,000. Education proportion classification was set by equal quartiles.

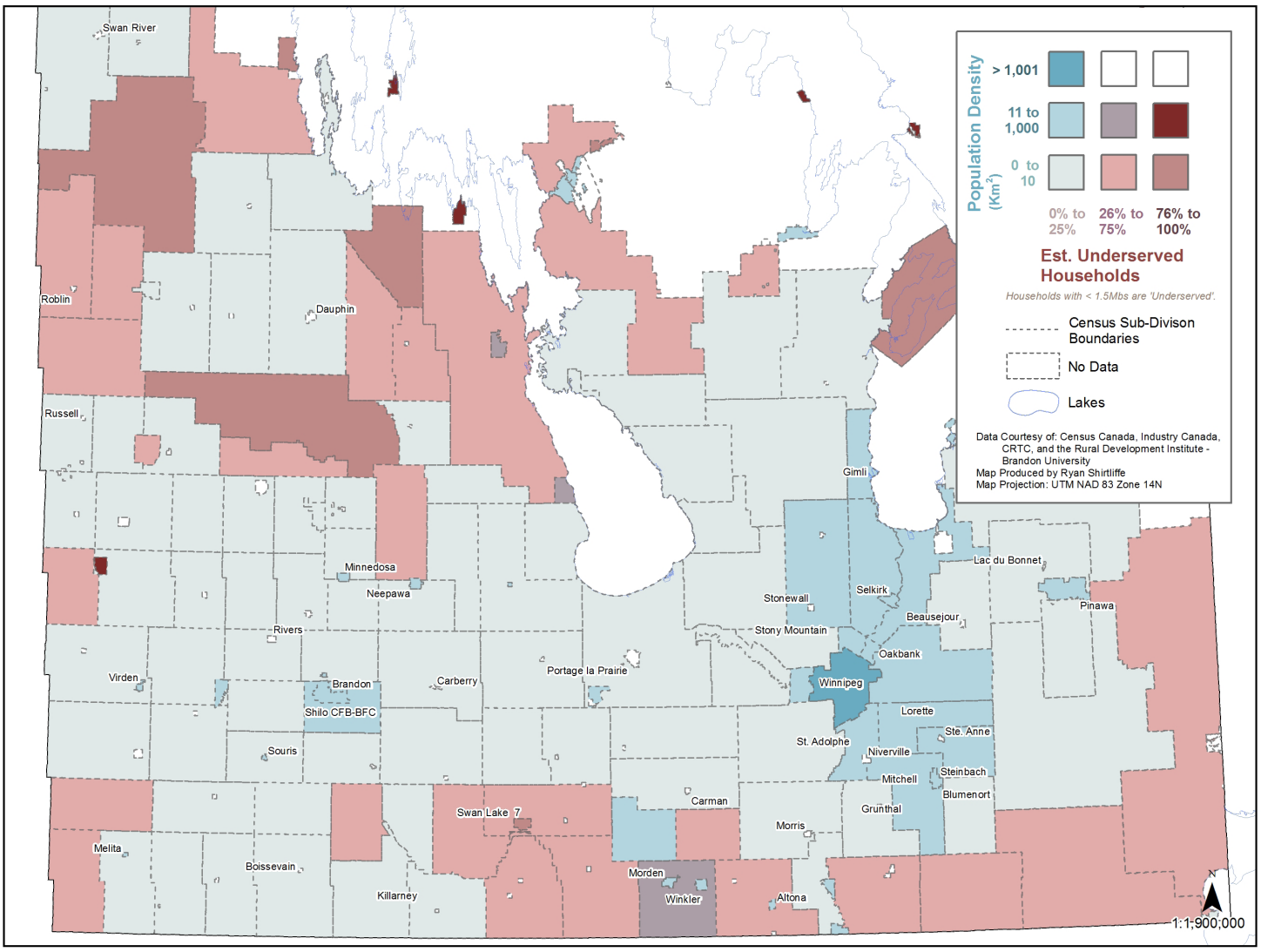
To generate Census Sub-Division (CSD) and SLAs population density maps, data from the hexagonal geography was amalgamated to the CSD level. SLAs maps were then generated from amalgamating the CSD map to each SLA. See Map 6 for a definition of the CSD used in this research brief.

# Appendix 2: Maps

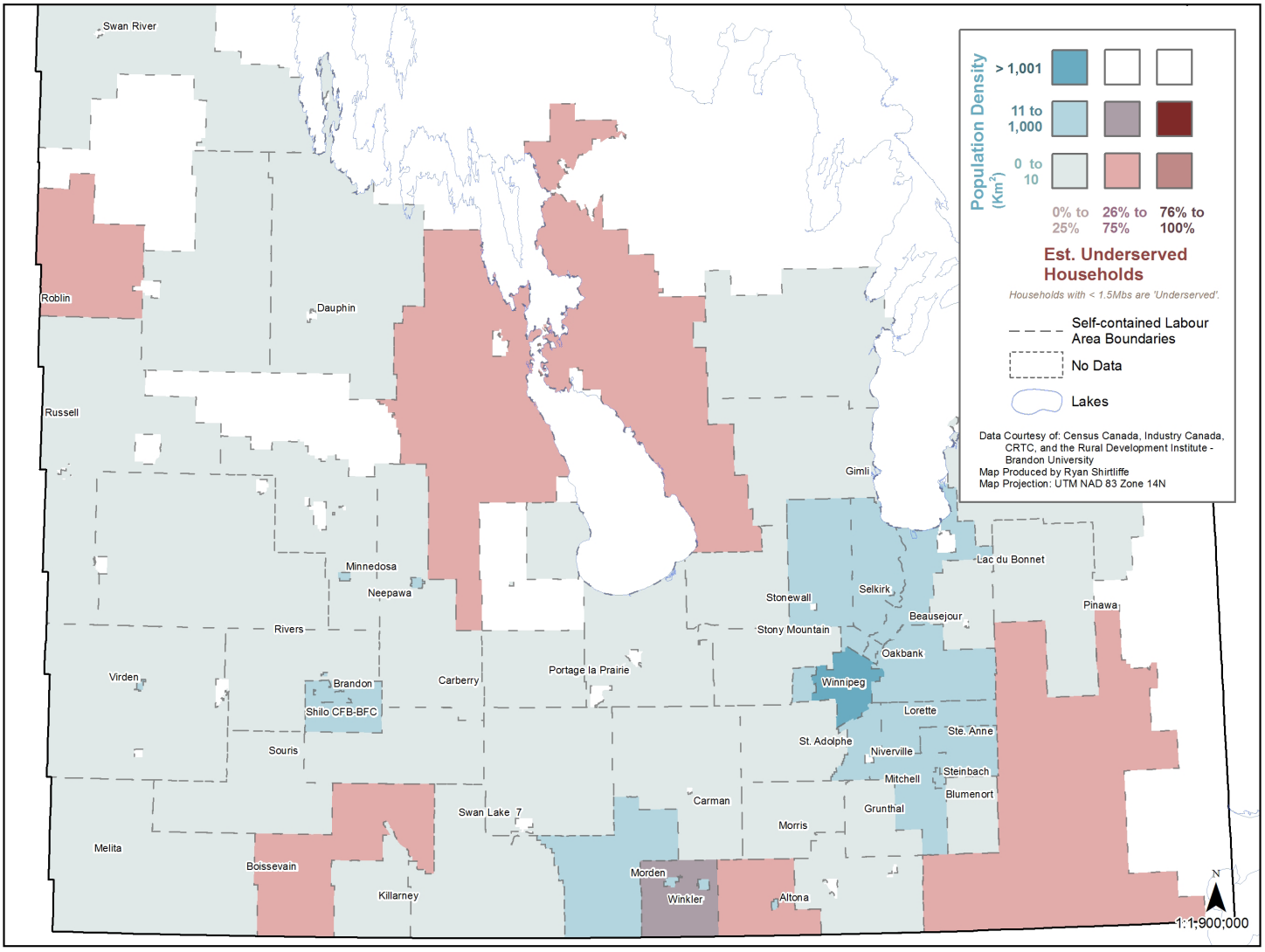
Map 1: Estimated Underserved Households (%) vs. Population Density (km$^2$) by Hex Data



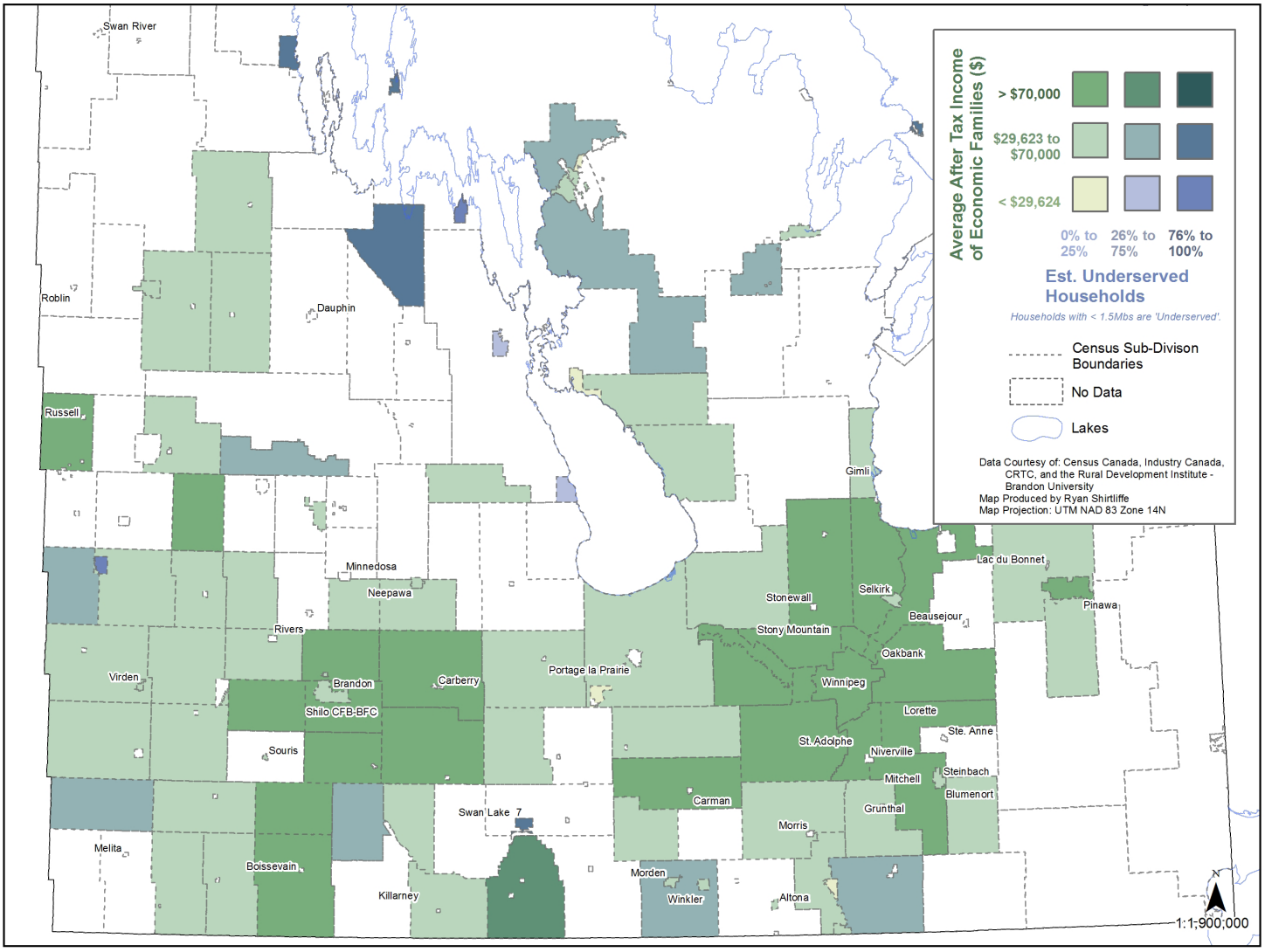
Map 2: Estimated Underserved Households (%) vs. Population Density (km$^2$) by Census Subdivision (CSD)



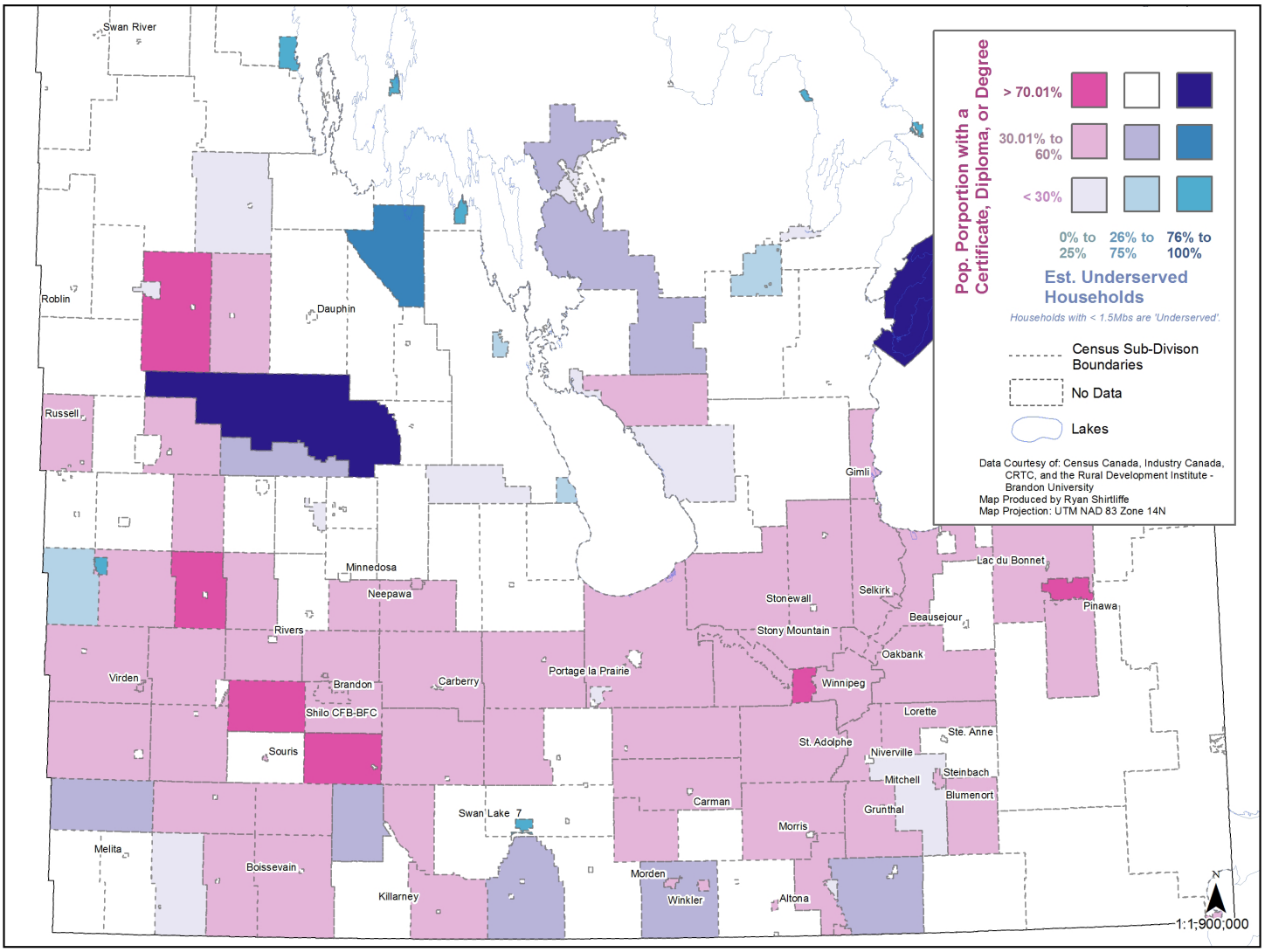
Map 3: Estimated Underserved Households (%) vs. Population Density (km$^2$) by Self-contained Labour Areas (SLA)



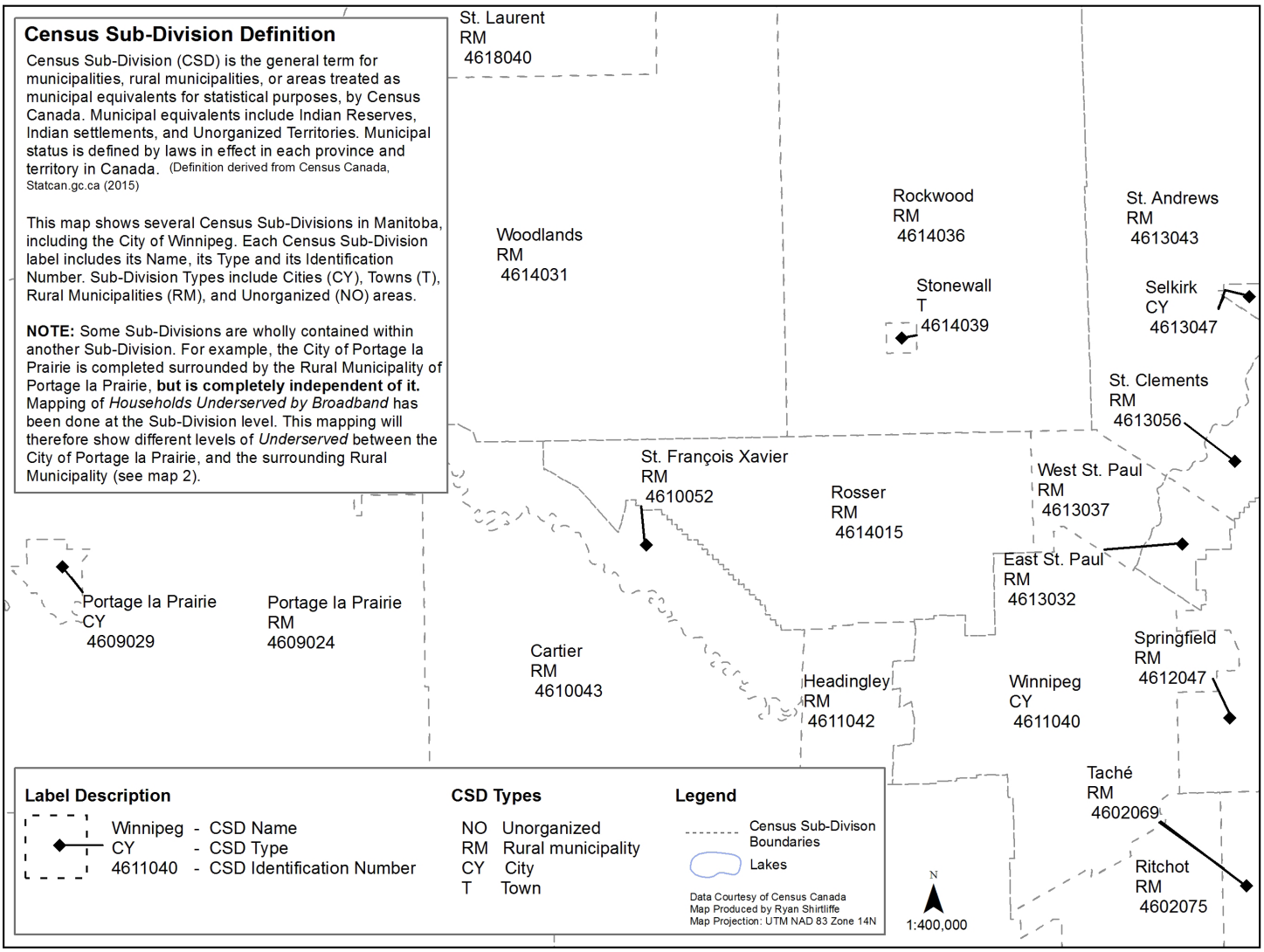
Map 4: Estimated Underserved Households (%) vs. Average After Tax Income of Families by Census Subdivision (CSD)



Map 5: Estimated Underserved Households (%) vs. Education Proportion (%) by Census Subdivision (CSD)



## Map 6: Census Sub-Divisions Definition



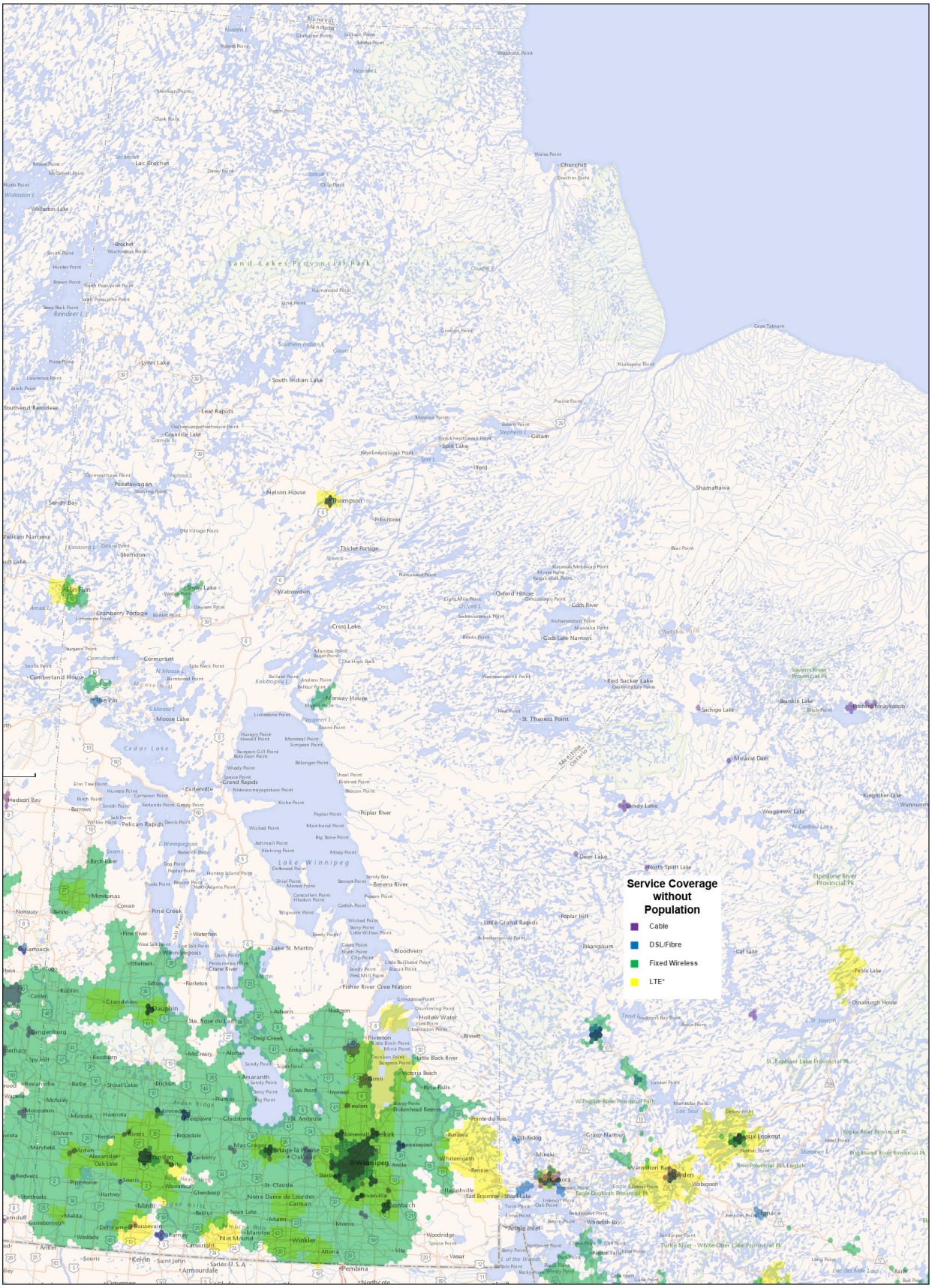
# Appendix 3. CRTC New Broadband Coverage Data

The data collection and research for this project report was completed in February 2016 with the report being finalized in March 2016. The readily available public data on broadband access across rural Manitoba at this point was limited to 1.5 Mbps access. In April 2016, shortly after this report was finalized, the Canadian Telecommunications and Radio Commission released a new interactive broadband map detailing access at 5 Mbps levels. That map can be found at this website: **http://crtc.gc.ca/cartovista/internetcanada-en/?_ga=1.48825510.1827180596.1458116292.**

The new publicly available data for rural Manitoba provides important new data on broadband coverage and some additional insights into rural broadband access but does not change the fundamental recommendations of this report which are located on page 2. The additional insights from CRTC's new data are as follows:

- Most of southern rural Manitoba has access to 5 Mbps broadband - the coverage is consistent with the reports findings for 1.5 Mbps.
- The regions of rural Manitoba identified in the report that were unserved/underserved for 1.5 Mbps remain unserved/underserved for 5 Mbps
- Fixed wireless is the broadband infrastructure with the greatest 5 Mbps coverage in rural Manitoba; LTE mobile broadband is the infrastructure with the second most 5 Mbps coverage in rural areas of the province
- Cable and DSL/Fibre are only available in some select rural towns

Map 7: Broadband service coverage in Manitoba at 5 Mbps (data from 2014, courtesy of CRTC and released April 2016)



Map 8: Unserved and Underserved populations in Manitoba (data from 2014, courtesy of CRTC and released April 2016)