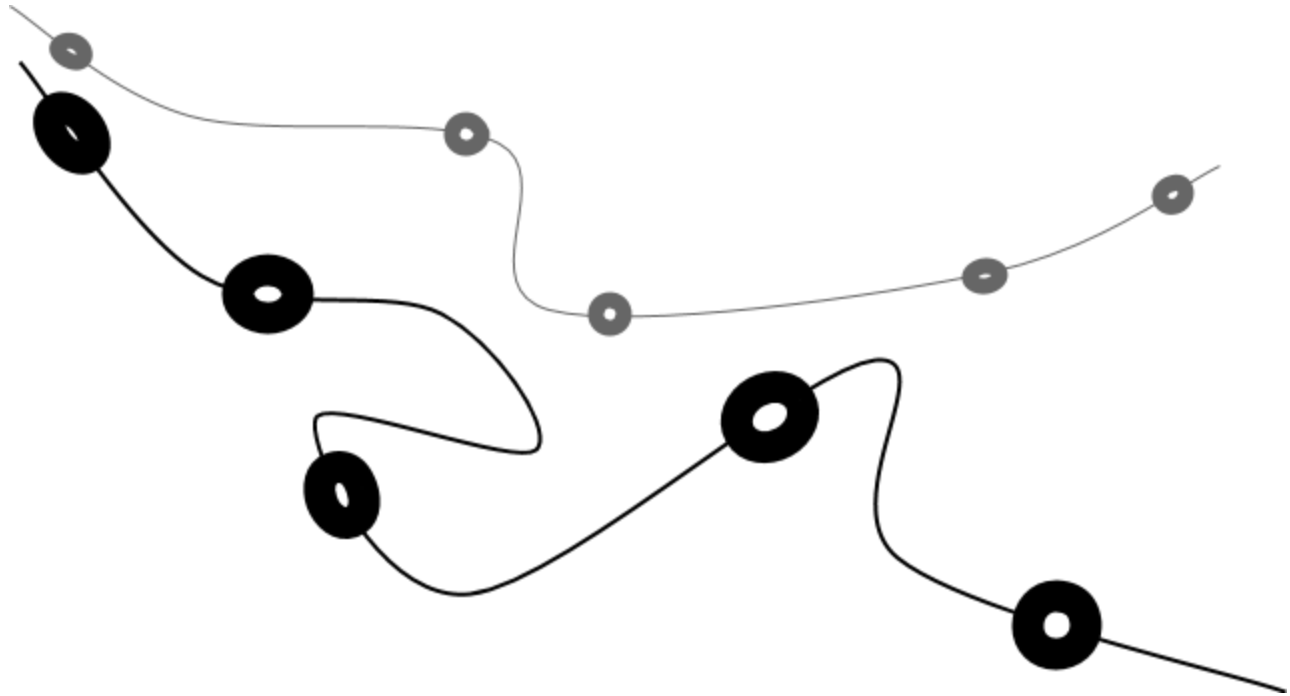


Dunn County: Rural Broadband Gap Analysis Study



Date: 1/17/2017



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Under the Direction of: Dunn County Community Resource and Tourism Committee

Adopted by: Dunn County Board of Supervisors

(For a listing of past and present Board of Supervisors contact the Dunn County Clerk.)

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Executive Summary

On June 15, 2016, the Dunn County Board of Supervisors (Board) passed Resolution 58 to strengthen and maintain broadband in Dunn County that would allow education, business, and industry to compete on a global level. The resolution became a catalyst for the service provider 24-7 Telcom to expand fiber broadband to the community of Rusk in the Town of Red Cedar. With increased interest in rural internet and broadband connectivity, the Community Resources & Tourism Committee (CR&T) formed a study team to assess the county's rural broadband gaps and needs. The team consisted of representatives from the University of Wisconsin-Extension, Dunn County Planning and Zoning Division, and Dunn County Economic Development Corporation. The broadband gap analysis concluded on January 17, 2018 with a full report presented to the Dunn County Board of Supervisors.

Broadband Basics

It is important to understand that broadband is an industry terminology for high-speed transmission of data over a broad range of frequencies. It is often used interchangeably with High-speed Internet and Cable Internet. The Federal Communications Commission (FCC) has defined "Broadband" as a minimum speed of at least 25 Megabits per second (Mbps) for downloads and 3Mbps for uploads. The definition still allows for many current and emerging technologies to meet these minimums such as: fiber, cable, satellite, digital subscriber line (DSL), WiFi, and cellular technology.

PSC/Broadband Expansion

To support broadband expansion in Wisconsin, the Broadband Expansion Grant Program was created. The program encourages the deployment of broadband-capable technologies in rural and remote areas of the state. The program was introduced in the 2013-15 biennial state budget with funds of \$500,000 annually and has increased with each biennial budget. The current 2017-19 state budget has allocated \$7.5 million towards broadband expansion. Included with the current 2017-19 state budget was a second round of 2018 Broadband Expansion Grants that was opened on October 11, 2017 with a January 25, 2018 deadline. Moving forward, the Broadband Expansion Grants deadline is anticipated to have a recurring June deadline.

Dunn County Study

The study was broken into two phases with Phase 1 consisting of community outreach efforts to the residents, businesses, towns and villages, and internet service providers about the broadband survey and study, as well as to allow for the public to ask questions and voice their concerns. Phase 2 involved gathering data to assess the county's broadband gaps and needs. A county broadband survey was conducted from June 20 to July 21. The survey was administered as hard copies and online. The University of River Falls' Survey Research Center (SRC) conducted further analysis of the survey outcomes. An important service provided by the SRC are maps using the survey responses to provide a spatial analysis of broadband gaps.

Key residential findings indicate that that internet service options are not distributed evenly across the county. There is high residential dissatisfaction with their internet service and with the primary reasons for not having internet was the lack of internet availability.

Key business findings indicated there is a high rate of internet adoption amongst business respondents but high levels of dissatisfaction with their internet service. Also similar to residential responses, there was a high response rate for lack of internet availability at their location as the primary reason businesses do not have internet.

Overall, the similarities shown between the business and residential respondents indicate that a real gap in the need for broadband connectivity exists. Businesses and residents with limited to no access or who are dissatisfied with their level of internet service tend to value reliable broadband connectivity more than those in areas that are well served such as in the City of Menomonie.

Future Direction

Dunn County's ultimate broadband goal is for everyone in the County to be connected. Through an implementation process containing a series of short and long term objectives, Dunn County will be positioned to meet its goal of countywide broadband accessibility to provide the quality of life and amenities expected of the county by its residents, businesses, and stakeholders.

The study identifies both short and long term objects to achieve the county's broadband goals. It is important to note that short term objectives may extend many years into the future and it is entirely possible that short and long term objectives could overlap. Within the first year from the start of implementation the short term objectives are to organize community conversations. These conversations are meant to inform service providers, local jurisdictions, businesses and the public at large on the broadband gap analysis study but also their roles in expanding broadband.

The long term objectives should be in place within two years from the start of implementation. The following are long term objectives:

- Advocate for broadband expansion.
- Develop a meeting schedule for the broadband team.
- Establish and maintain relationships with service providers.
- Organize quarterly "Broadband" community discussions.
- Maintain membership in Region 3 Broadband Implementation Group.

While this study establishes objectives to meet the County's broadband goals, it is important to note that "Broadband" is also a component of the County's Directional Plan (a framework of Values and Initiatives). The plan promotes prioritizing the use of public assets through a collaborative planning process as a means to achieve the County's Mission as a "Proactive Government" and Vision to "protect and empower" the citizens. The internet has the potential to increase the human capacity especially in remote areas who would not otherwise have the same opportunities as those in urbanized areas. The broadband gap analysis is the initial step to understand where gaps exist in the county. The outcome of this study provides valuable information and insight to help the county prepare its residents and businesses for a future that includes broadband accessibility.

Contents

Acknowledgement 3

Executive Summary 4

Definitions 8

Introduction 10

Broadband Basics 11

Broadband Technologies 13

Telephone networks 13

Cable networks 14

Fiber 15

Fixed Wireless Technology 17

Mobile Hotspot 18

Satellite 20

Other Technology 22

White Space (Super Wifi) 22

Broadband over Power Lines 23

Dunn County Overview 25

Regional Setting 25

Demographics 27

Impacts of Broadband 31

Government Transparency and Public Engagement 32

Healthcare 33

Public Safety and Emergency Response 33

Education 33

Economic 34

Dunn County Internet Service Providers 38

Incumbent Local Exchange Carrier and Competitive Local Exchange Carrier 38

Broadband Expansion Grants 39

Open Submittal Period 39

Program Eligibility 39

Dunn County Rural Broadband Study 40

Resolution 58 40

Methodology 40

Phase I - Community Outreach 40

Phase II - Data and Needs Assessment 41

Survey Analysis	43
Residential Responses	43
Residential Respondents with Internet Service	43
Residential Broadband Service Fee	43
Residential Non-subscribers	43
Home Businesses and Telecommuting	43
Business Responses	44
Business Ownership	44
Business Access	44
Business Satisfaction	44
Business Growth	44
Business Non-Subscribers	45
Relocating Out of the County	45
Open Ended Survey Comments	45
Residential Survey Open Ended Comments	46
Business Survey Open Ended Comments	46
Survey Map Analysis	47
Residential Map Analysis	48
Business Map Analysis	49
Future Directions for Dunn County	50
Broadband Goals	51
Short Term Objectives	52
Long Term Objectives	52
Moving Forward	54
Appendix	55
Bibliography	86

Definitions

1G: First generation cellular technology.

2G: Second generation cellular technology.

3G: Third generation cellular technology.

4G: Fourth generation cellular technology.

5G: Fifth generation cellular technology.

Bandwidth: The measurement of the maximum transfer rate of a network cable or device in bits per seconds. The higher the bandwidth, the faster your connection and speed is.

Broadband: Defined by the FCC as a high speed internet connection with a minimum of 25Mbps download/3Mbps upload speeds.

Cable: An insulated copper wire(s) often with a protective casing used for transmitting electricity and telecommunication signals.

Census blocks: A small geographic boundary used by the United States Census Bureau for data collection described as all the data within the boundary such as all houses rather than individual homes. Boundaries can be created from a variety of features such as roads, streams, railroads, and nonvisible boundaries such as property lines, city, townships, and school districts.²

Cellular: A mobile telephone system that uses radio frequencies that automatically switch between telecommunication towers in order to cover a large area for mobile telephone users.

Central Office: The office where telecommunication services originate from for home and business telephone and internet subscribers.

Disruptive Innovation: A process by which a product or service creates a new market or value that disrupts the existing market or value.

Disruptive Technology: A disruptive innovation, by which the product or service is technology related that disrupts the existing market or value with the creation of a new market or value (i.e. the internet).

Fiber-optic (fiber): A technology that uses flexible strands or threads of glass wire to transmit data. Fiber-optic wires are similar to cable wires but instead of copper wires it uses glass wires.

Gigabits per second: Measure of a unit of data transfer of 1 gigabit per second which is the

² Rossiter, Katy. "What Are Census Blocks?." The United States Census Bureau. N.p., 2017. Web. 17 Nov. 2017.

equivalent of 1,000 megabits.

Home-based businesses (from Dunn County Comprehensive Zoning Ordinance - “Home Occupation”): A gainful occupation customarily conducted within a dwelling or accessory building by the residents thereof, which is clearly secondary to the residential use and does not change the character of the structure as a residence.³

Hotspot: A device that provides mobile Wifi connection anywhere such as a Verizon Jetpack or AT&T hotspot devices.

Kilobits per second: Measure of a unit of data transfer of 1 kilobit per second which is the equivalent of 1,000 bits.

Latency: the delay between the transfer of data from its origin to final destination. An example is the delay in sending an email especial with large files that include pictures.

Megabits per second: Measure of a unit of data transfer of 1 megabit per second which is the equivalent of 1,000 kilobits.

Satellite: A technology where a device is placed in orbit around the earth and can be used to transmit information back to earth.

Wifi: A method of allowing computers and devices to connect to the internet wirelessly within a small area such as a restaurant or hotel.

³“Dunn County Comprehensive Zoning Ordinance.” Dunn County. 2017. Print.

Introduction

This report was authorized by the Community Resource and Tourism (CR&T) Committee as a means to understand gaps in rural broadband service within Dunn County. The study relied on a user needs survey, a gap analysis and a series of maps illustrating gaps of broadband coverage across Dunn County. The report provides valuable information on the current state of rural broadband access across Dunn County and is intended to be a resource for government entities and service providers to improve county-wide broadband access.

The report was developed using public sources, research reports, articles, and input from county residents and businesses via a broadband survey. The survey results are also depicted on the series of maps accompanying this report.

The report is divided into four sections:

- Broadband Basics
- Dunn County Overview
- Broadband Gap Analysis
- Future Directions

Broadband Basics

In general, broadband is high-speed transmission of information on a wide band of frequencies. It can be hardwired or wireless and includes: fiber, cable, satellite, digital subscriber line (DSL), WiFi, and cellular technology. Broadband is often used interchangeably with High Speed Internet and Cable Internet, as broadband is an evolution and advancement of telecommunication services and networks. Traditional phone networks were designed to deliver voice services to its users within a narrow band (64 kilobits per second). There is no consensus on the actual standard for minimum speed of broadband service however, the Federal Communications Commission (FCC) has stated that a minimum broadband speed for downloads should be at least 25 Megabits per second (Mbps) for downloads and 3Mbps for uploads.⁴

High speed internet evolved because telecommunication and cable network providers were interested in developing new technologies to deliver high definition streaming videos and audio to its customers. Initially internet users needed intermittent or sporadic connections, however, demand has advanced to the point where constant connection is a necessity. Presently, traditional electronics and appliances now include some sort of online or Wi-Fi feature.

While computing technology was not common in the majority of homes in the 1980s, today it is normal to have more than one computer and several other devices in homes. The internet is now a universal method of communication and information exchange. Internet in our personal lives and home environments provide access to socializing and professional networking, and is often instrumental in performing household tasks. Access to the internet provides a variety of online interaction opportunities including platforms and features such as Facebook, Twitter, LinkedIn, online forums, website comments, Skype, etc. Not only have these devices become a household tool but they have also become a necessity for nearly every type of business.

Businesses rely on computers for documentation, recordkeeping, accounting, customer communications, and other activities. The evolution of the internet has expanded the business community's ability to easily share and communicate with clients and customers (i.e. video conferencing, cloud-sharing, dynamic documentation editing, etc). Even non-computer based businesses rely on computing technology to run their day to day activities such as Quickbooks for easy tax filing, online banking, and computer-based mapping for agricultural businesses. In order to effectively support the business community, including home-businesses, reliable broadband access is critical in our modern world. All facets of video (production, distributing, and sharing) has become one of the defining components of the Internet. Applications such as Youtube have altered the use of computing to a new dynamic. Not only can users retrieve content, but they have the ability to generate and share video to the global public. This is important because video allows users a medium to communicate, express themselves, and market their business worldwide.

Other industries and systems such as education, transit, healthcare, and security represent the services and potential of broadband's impact on economic and community development. As we move forward with advancements in technology and improvement in delivery of services, additional bandwidth for all applications will be needed.

⁴ "2016 Broadband Progress Report." Federal Communication Commission. 29 Jan. 2016, www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report. Web. 8 Aug. 2017.

Table 1 below provides examples of the activities and the minimum download speeds necessary to perform certain activities. The examples are for a single device on the network. If multiple devices are used at the same time the speed or bandwidth required will need to be increased to effectively use all the devices. For example, if a household is streaming a movie and downloading data at the same time they will need between 13 to 34Mbps of broadband speeds. As more devices, appliances, and services utilize broadband technologies it will be important that networks and bandwidths continue to evolve to keep pace demand.

Table 1: Broadband Speed Guide

Activity	Minimum Download Speed (Mbps)
General Usage	
General Browsing and Email	1
Streaming Online Radio	Less than 0.5
VoIP Calls	Less than 0.5
Student	5 - 25
Telecommuting	5 - 25
File Downloading	10
Social Media	1
Watching Video	
Streaming Standard Definition Video	3 - 4
Streaming High Definition (HD) Video	5 - 8
Streaming Ultra HD 4K Video	25
Video Conferencing	
Standard Personal Video Call (e.g., Skype)	1
HD Personal Video Call (e.g., Skype)	1.5
HD Video Teleconferencing	6
Gaming	
Game Console Connecting to the Internet	3
Online Multiplayer	4

(These numbers are rough guidelines and are not based on surveys or experiments conducted by the FCC. You should use your best judgment when choosing your broadband service.

Source: Federal Communication Commission)

Broadband Technologies

At the internet's infancy dial-up was the only method to connect to the internet with very slow speeds. Today the telephone is still one of the major telecommunication mediums because of advancements in technologies and also for its wide reaching networks in rural areas . In addition to the telephone networks there are several types of technology capable of delivering broadband services to users such as:

1. Telephone networks,
2. Cable networks,
3. Fiber,
4. Fixed wireless,
5. Mobile hotspots and satellite

While each technology operates somewhat differently, they are all capable of reaching speeds of 25Mbps/3Mbps or more per user. Many of these technologies were developed in the 1990s and have gone through advancements since their inception .

Telephone networks

The telephone can be considered one of the great human achievements for allowing person-to-person voice communication across great distances. This was made possible in the United States from investment in the cable infrastructure (of which copper was most common) which was leveraged by the telephone networks to deliver voice services to homes and businesses for 65 plus years. Telecommunication manufacturers eventually developed Digital Subscriber Loop (DSL) technology to deliver broadband services to users. The copper base infrastructure allows telephone companies to deliver cable services through incremental investments which reduces the need to acquire right-of-ways or excavating streets, lawns, shoulders, etc.

New housing and industrial developments can encounter roadblocks associated with justifying the cost of installation of fiber and copper cables from telecommunication companies. The cost difference between copper and fiber is significant but with an increasing emphasis on greater bandwidth the long-term investment favors fiber (more on this later in Fiber section). The major disadvantages of a telephone/copper cable network are:

1. Signal diminishes over long distance
2. Low bandwidth

The central office (otherwise known as the office that telephone subscribers are connected to by their phone line) can compensate for diminishing signals with electronics box or nodes placed throughout the network to boost the signal. However, financial investment has to be justified. Usually this means a sufficient number of homes and/or businesses must be served for a node to be considered. In many instances, nodes can be identified as roadside boxes and require fiber to carry signals from them back to the main electronics building. The cost of fiber and sometimes even copper has to be considered when making a business case even if it ends up being negative (essentially the initial cost of the capital technology is higher than the anticipated revenue).

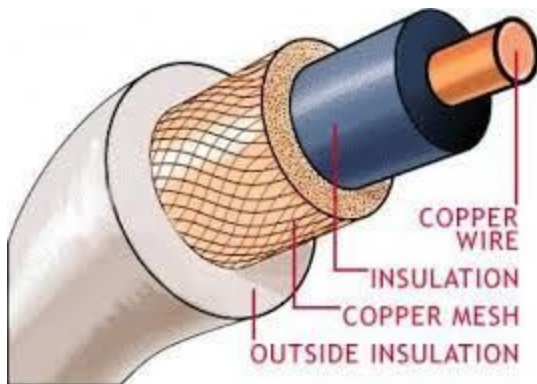
For example a business case based on the low number of homes per square mile with copper technologies which do not have DSL service might conclude, there is a limited case for installing fiber in rural areas.

It's these negative business cases which often leaves the phone company at a loss to place Digital Subscriber Loop (DSL) services in areas with low population density such as in Dunn County.

Cable networks

The progression in the evolution of internet access from dial-up and DSL is cable. Cable networks utilizes coaxial cable (with the most basic design consisting of an inner conductor surrounded by insulation followed by a conducting shield and then an insulating outer jacket/sheath).

Figure 1: Coaxial Cable Diagram

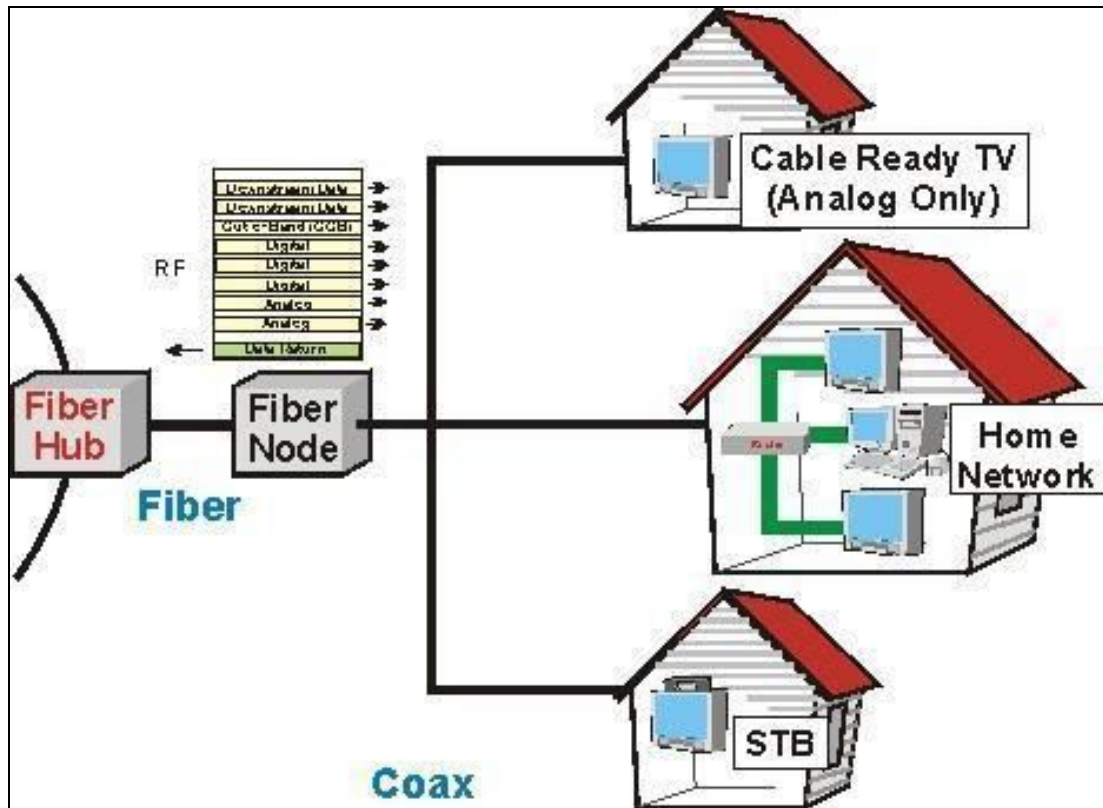


(Source: <http://searchnetworking.techtarget.com/>)

The design allows for a copper wire to shield noise and protect the signal from degrading, hence extending the distance a signal may travel. Traditionally cable networks were used to deliver TV services. Cable companies typically only offered cable services in rural areas with a fairly dense cluster of homes. The other alternatives for rural residents to gain tv services were amplified antennas (that still needed to be within range of the towers) or satellite dishes.

Much like the telephone companies and DSL, cable networks had to alter their networks to be capable of delivering broadband services but, cable networks were less sensitive to signals degrading over great distances. Cable networks face the same limitation as the telephone company in that existing cable infrastructure does not already reach every home, thereby limiting the business case for cable companies to provide services to residents not located in high density areas and again greatly affects those in rural areas.

Figure 2: Example of Cable Network to Homes



(Source: <http://alhadeeruae.com>)

Fiber

Fiber optic technology has existed since the 1790’s as the optical semaphore telegraph invented by French inventor Claude Chappe⁵. Later in the 1880’s Alexander Graham Bell invented the photophone that transmitted speech over a fiber optic-like medium, but his other invention, the telephone, was more practical and tangible⁶. Fiber as we know it today has only existed since the 1970’s when researchers decided to fuse silica together resulting in faster speeds and higher capacity broadband services.

There are many different fiber applications with fiber to home as the most popular. Fiber comes directly to an individual home much the way the copper and coaxial do for telephone and cable services. The main advantage of fiber is its bandwidth. With fiber the amount of bandwidth is determined by the internet provider. For the purposes of most users, fiber has more capacity (bits per second) than most users can imagine using. Additional advantages of fiber are:

1. Reliability
2. Security

⁵ Alwayn, Vivek. "Fiber-Optic Technologies > A Brief History Of Fiber-Optic Communications." Cisco Press.com. N.p., 2017, www.ciscopress.com/articles/article.asp?p=170740. Web. 28 Aug. 2017.

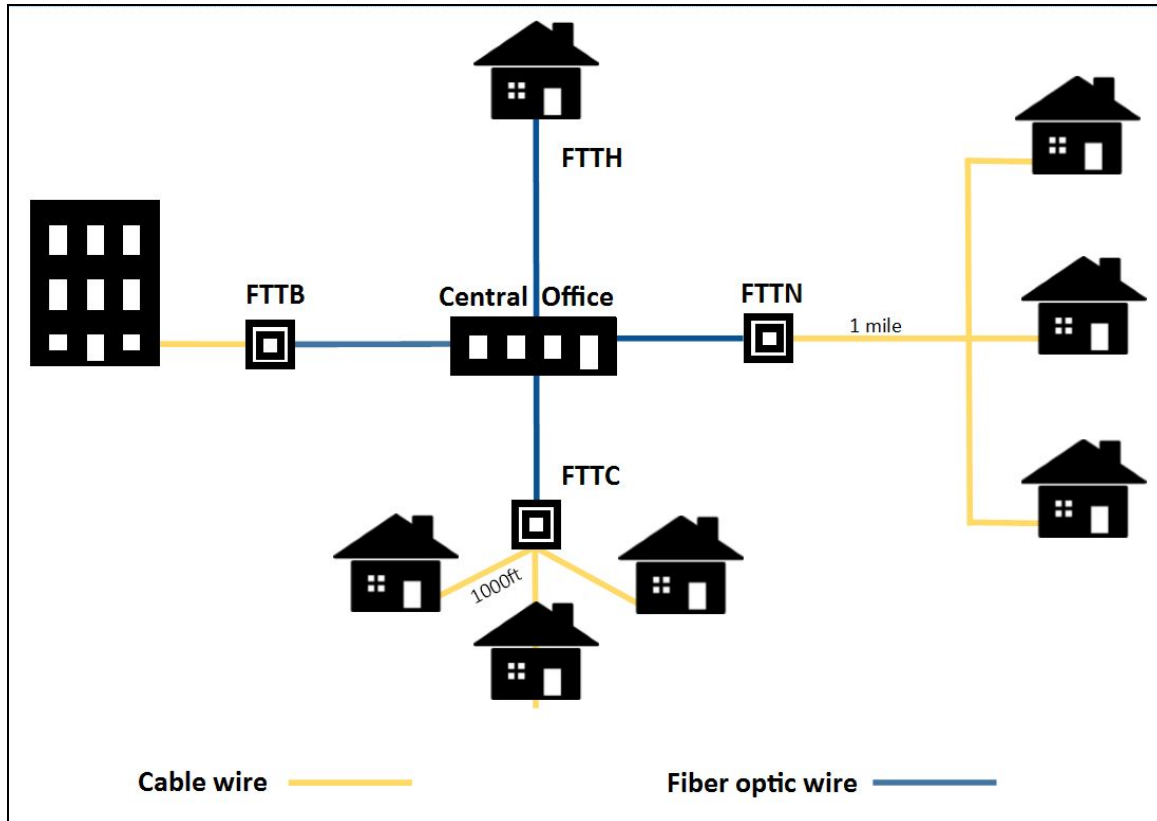
⁶ *ibid.*

3. Capacity

The most significant challenge to installing fiber to rural areas is the price tag. The majority of the cost of fiber to the home (FTTH) is trenching and/or attaching wires to poles to reach rural homes. While the investment in fiber offers a future-proof infrastructure able to support the projected increased service demand, it is the low density (homes per square mile) in rural areas which makes fiber not a viable option. To reduce the overall cost a fiber-hybrid infrastructure can be utilized. With this approach, different strategies can achieve the desired level of service by applying the following approaches:

- Fiber to the Curb (FTTC) is a method where fiber is wired to the curb of homes and then coaxial or copper is wired from the curb to the homes that are within 1,000ft. This is an option for clustered and higher density housing areas.
- Fiber to the Node or Neighborhood (FTTN) is similar to FTTC where fiber is wired to a central node within 1 mile from homes (also referred to as the “last mile”) and then the connection is completed with coaxial or copper. Clustered residential areas are candidates for this approach.
- Fiber to the Building (FTTB) is fiber wired to a building and then coaxial or copper is wired throughout the building. This is an option for apartments and office buildings.

Figure 3: Diagram of Fiber Networks (FTTH, FTTC, FTTN, and FTTB)



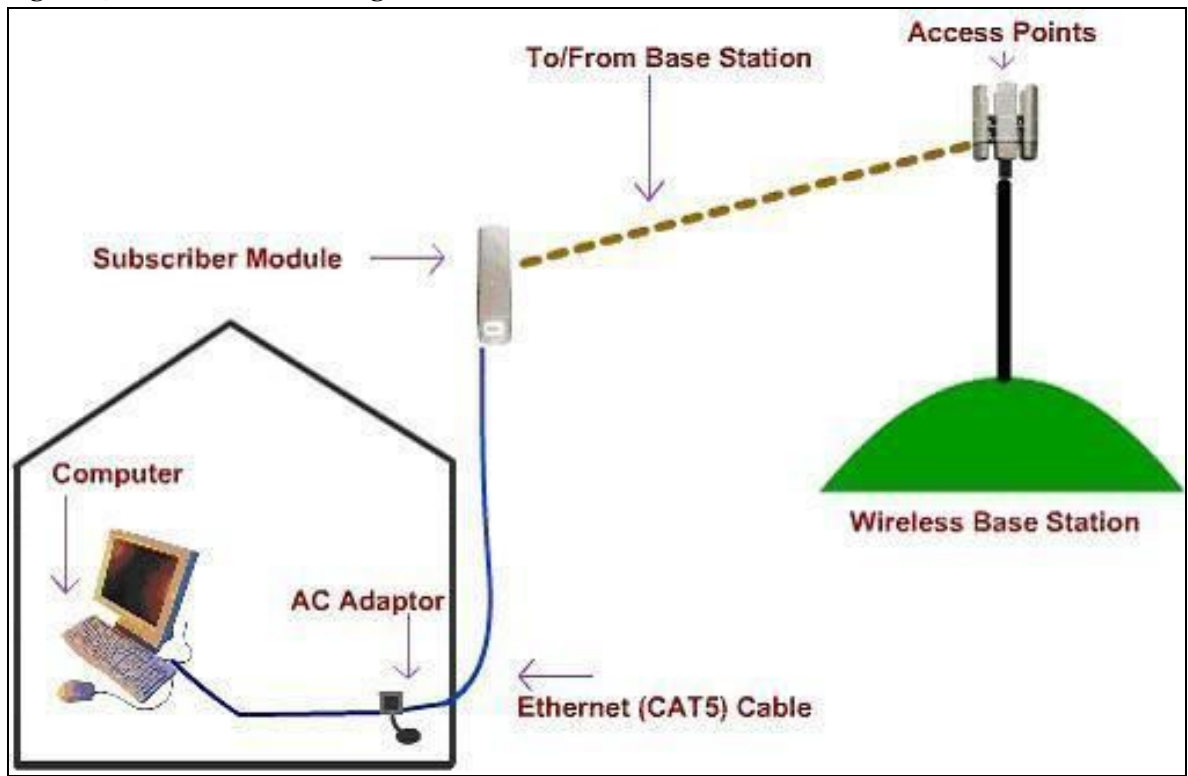
(Source: Dunn County)

It is important to understand that there is fiber running along many routes today and while many are active (meaning electronics are attached and carrying signals), it generally runs from point to point. Meaning the fiber line runs from one major hub location to another often to a carrier. The individual houses and businesses along these fiber lines may not be able to access the fiber for their services due to a variety of reasons. Often times these fiber infrastructure were developed at a time when broadband access were not regarded as important as it is today therefore many homes and businesses either opted to not be connected to fiber or the provider simply passed them by. If a business (and to some extent homeowners) require greater speeds and bandwidth, they can pay a provider to connect a fiber line from the closest hub location to their location. However these services are not inexpensive and are often beyond the reach of many smaller businesses.

Fixed Wireless Technology

An alternative to wired infrastructure is wireless technology. In wireless networks antennas are used to transmit signals through the air. Fixed networks use antennas called subscriber modules which are mounted on buildings to receive the signals.

Figure 4: Fixed Wireless Diagram



(Source: www.dupagewireless.net)

Aside from infrastructure cost wireless networks have other limitations in signal transmission such as; interference (or signal blocking) and loss of signal due to trees, terrain, and distance to towers.

Rural and remote areas with low residential density are prime locations for wireless technology.

Capital investments in wired infrastructure to reach remote areas can be expensive due to terrain, right-of-way access, and distance. Existing towers provide a structure to install antennas which allow service providers to reduce their cost for internet service.

Mobile Hotspot

Stick technology was one of the first widely available options for mobile internet access in the form of dongles or usb sticks which can be plugged into a laptop to access the internet anywhere, but has been phased out. Today, mobile hotspots improves on stick technology by providing wireless internet access and the ability to connect multiple devices at the same time. It also improves on the fixed wireless network by allowing hotspot devices to be mobile. Essentially, it's a small box that can easily be transported by the consumer, that allows for mobile wireless internet access. . This technology has taken off due to today's many electronic devices having built-in wireless capabilities.

Mobile hotspots utilizes cellular technology and takes advantage of existing technology and infrastructure. While a smartphone can be utilized as a mobile hotspot it does not provide the reliability and efficiency a dedicated mobile hotspot offers. Mobile hotspot benefits include:

- Hardware built to manage multiple devices compared to a cell phone's hotspot
- Secured wifi connection when in public spaces
- Mobility

It does require a carrier and data plan much like today's smartphones. Therefore data limits may be enforced unlike the other types of internet technologies.

Cellular technology was originally developed as basic analog systems strictly for voice calls (1G technology). As such, mobile wireless technology was originally developed and implemented to target a mobile market such as salesmen, students, business people, etc. who required only a limited or short-term internet access at any given time of the day, while performing a minimal set of activities/interactions. As such, the design of these networks were not intended to handle heavy users requiring long periods of connectivity. Today more and more users demand constant internet connections, for the transmission of data, instead of purely voice, to smartphones and other devices. It has become the norm for the everyday person to always be connected to the internet, whether hardwired or wireless. As such cellular technology has continuously advance to meet the increasing demand of mobility and access to the internet.

The advancement and evolution of cellular technology helped to bring mobile hotspot technology to the masses as a viable option for internet access. Table 2 shows a comparison and the evolution of cellular technology from 1G to 4G. Where the number represents the chronological improvement in cellular technology and the "G" stands for generation. For example the first generation of cellular technology is "1G" or "1st Generation" and the current generation of cellular technology is "4G" or "4th Generation" which represents the 4th evolution in the cellular technology.

Table 2: Comparison of the Generation of Cellular Technology

Parameters	1G	2G	3G	4G
Name	"1st Generation" Mobile Network	"2nd Generation" Mobile Network	"3rd Generation" Mobile Network	"4th Generation" Mobile Network
Phone/ hardware				
Introduced in year	1980s	1993	2001	2009
Location of first commercialization	USA	Finland	Japan	South Korea
Technology	AMPS (Advanced Mobile Phone System), NMT, TACS	IS-95, GSM	IMT2000, WCDMA	LTE, WiMAX
Multiple Address/ Access system	FDMA	TDMA, CDMA	CDMA	CDMA
Switching type	Circuit switching	Circuit switching for Voice and Packet switching for Data	Packet switching except for Air Interface	Packet switching
Speed (data rates)	2.4 Kbps to 14.4 kbps	14.4 Kbps	3.1 Mbps	100 Mbps
Special Characteristic	First wireless communication	Digital version of 1G technology	Digital broadband, speed increments	Very high speeds, All IP
Features	Voice only	Multiple users on single channel	Multimedia features, Video Call	High Speed, real time streaming
Supports	Voice only	Voice and Data	Voice and Data	Voice and Data
Internet service	No Internet	Narrowband	Broadband	Ultra Broadband
Bandwidth	Analog	25 MHz	25 MHz	100 MHz
Operating frequencies	800 MHz	GSM: 900MHZ, 1800MHZ CDMA: 800MHZ	2100 MHz	850 MHz, 1800 MHz
Band (Frequency) type	Narrow band	Narrow band	Wide band	Ultra Wide Band
Carrier frequency	30 KHZ	200 KHZ	5 MHz	15 MHz
Advantage	Simpler (less complex) network elements	Multimedia features (SMS, MMS), Internet access and SIM	High security, international roaming	Speed, High speed handoffs, MIMO technology, Global mobility
Disadvantages	Limited capacity, not secure, poor battery life, large phone size, background interference	Low network range, slow data rates	High power consumption, Low network coverage, High cost of spectrum licence	Hard to implement, complicated hardware required
Applications	Voice Calls	Voice calls, Short messages, browsing (partial)	Video conferencing, mobile TV, GPS	High speed applications, mobile TV, Wearable devices

(Source: <http://www.zseries.in>)

As demand for faster speeds and greater bandwidth continue, the next evolution of cellular technology already is in development in 5G. As 4G technology nears its peak capacity with speeds of 1gbs (gigabytes per second), 5G is expected to improve on latency (the lag time between two nodes or networks), fiber-like speeds of 10gbs, and could possibly replace home networks. 5G does have its limitations requiring towers to be within close proximity to each other keeping 4G relevant

due to an existing infrastructure and to provide a broader coverage, especially in rural areas⁷.

Reports speculate that by late 2018 5G will be available too in the United States from Verizon, while, other speculations suggest 2020 from T-mobile.^{8, 9, 10} Other than speculations, the fifth generation of cellular technology is currently being developed and tested for future deployment.

Satellite

While satellite is not considered a technology that provides the level of service of wired technologies, it allows residences in remote areas access to broadband, voice, and cable services. This attribute has potentially increased the relevance of satellite over the past decade with very positive annual growth rates in revenues in the global satellite industry (including services, manufacturing, installation of equipment, and support) but has potentially peaked with minimal growth the last two years and has been declining annually over the last five years (see Table 3). Over that same time period the U.S. has made up approximately 44% of the market share¹¹. The largest segment of this industry is service worldwide, possible boosted by the increased demand for rural broadband access. However, 77% of all satellite services was tv service compared to only 3% for broadband service.

⁷ Sascha Segan. "What Is 5G? | PCMag.com." PC Magazine. 1 May 2017.

<https://www.pcmag.com/article/345387/what-is-5g>. Accessed 24 Aug. 2017.

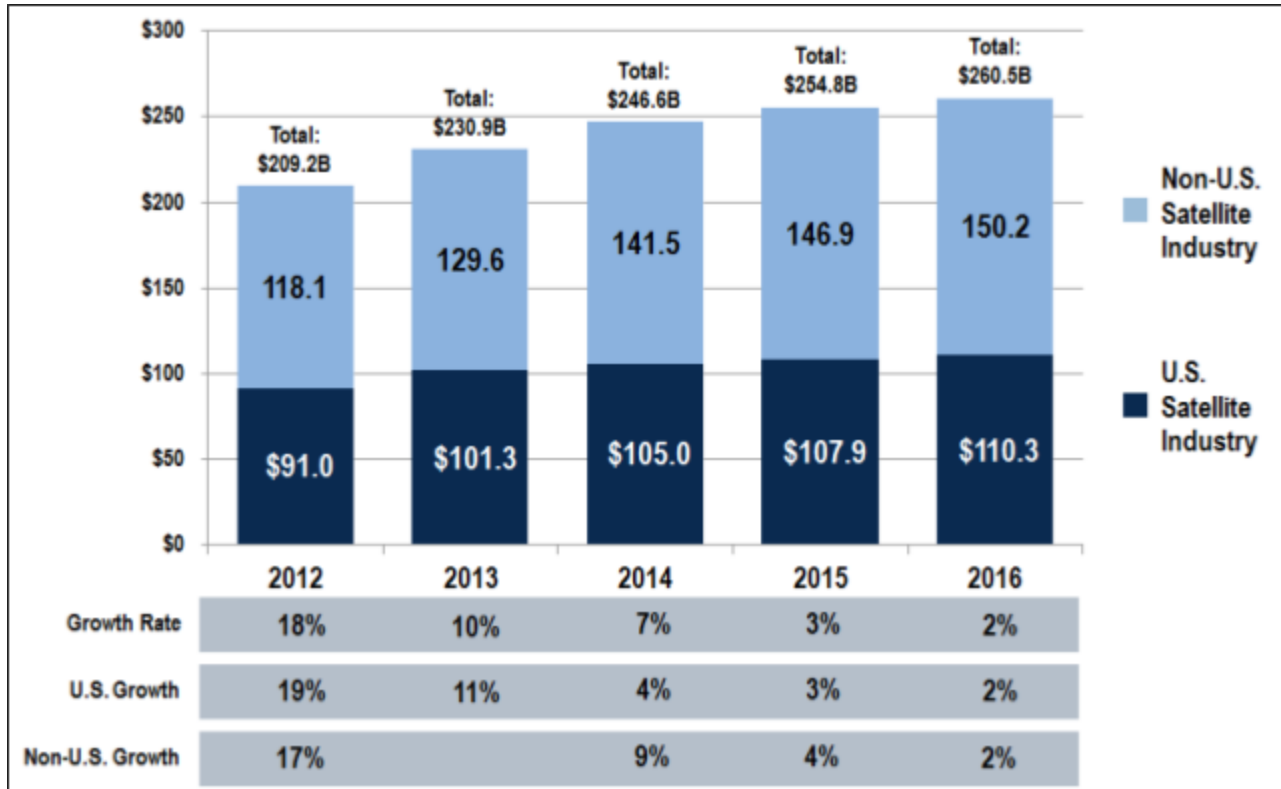
⁸ Shankland, Stephen. "5G networks could bring 'unlimited data' to your phone in 2019." *CNET*. 16 Oct 2017. Web. 12 Dec. 2017.

⁹ "Verizon Eyes Bigger Role In Residential Broadband As It Builds Out" *Forbes.com*. 4 Dec. 2017, <https://www.forbes.com/sites/greatspeculations/2017/12/04/verizon-eyes-bigger-role-in-residential-broadband-as-it-builds-out-5g-network/#32966ad59689>. Web. 12 Dec. 2017.

¹⁰ "Verizon hits back at T-Mobile over 5G claims." *BGR*. 9 Dec. 2017, <http://bgr.com/2017/12/09/verizon-vs-t-mobile-5g-speeds-deployment/>. Accessed 12 Dec. 2017.

¹¹"2017: State of the Satellite Industry Report." Bryce Space and Technology. June 2017. PowerPoint presentation.

Table 3: U.S. Portion of Global Satellite Industry Revenues



(Source: Satellite Industry Association)

As demand for rural broadband increase, initiatives from technology companies to utilize satellite technology as a source of delivering broadband have also increased. Initially the intention was to use satellite connectivity for backhaul (aggregated traffic/users) from remote locations but dependency on internet access has expanded the original purpose .

The dependency on reliable and fast broadband access is only going to continue to increase due to the convergence of technology and the internet. With greater emphasis on the internet, rural areas without proper internet infrastructure to deliver broadband services will be at a disadvantage. Their education, economy, and quality of life will all be affected. Satellite technology has been able to bridge some of this gap but the technology still has to be developed to provide more reliable, fast, and greater bandwidth to rival the wired technology.

Some of the largest tech companies have investing in some form of satellite technologies to deliver internet service to even the most remote areas. Google, SpaceX, and OneWeb are three companies with similar strategies of developing low orbiting satellites. OneWeb recently was permitted by the Federal Communication Commission (FCC) for low orbit satellites in the U.S. with other companies being reviewed.¹² OneWeb proposed to create “a constellation of 720 satellites evenly

¹² "Federal Communications Commission FCC 17-77 Before the Federal" Federal Communications Commission. 22 Jun. 2017, https://apps.fcc.gov/edocs_public/attachmatch/FCC-17-77A1.pdf. Print 31 Aug. 2017.

distributed in 18 near-polar orbital planes, at an approximate altitude of 1200 kilometers,”¹³ and would operate at a specific spectrum as documented by the FCC’s “Order and Declaration of Ruling.”¹⁴ The objective of these low orbiting satellite would provide less latency, faster speeds, increased reliability, and greater broadband access in the most remote areas.

As demand and interest in support of rural broadband access increase, Direct-to-Home satellite service will remain a viable means of offering full broadband services to remote locations and rural homes, especially those not adjacent to areas of high household density.

Other Technology

White Space (Super Wifi)

White space technology is an emerging technology with the potential to provide broadband connectivity to many households and businesses. While fixed wireless can send signals great distances, it’s major disadvantage is the need to be in line-of-sight (or it’s inability to pass through trees, hills, and buildings). Wifi technology alleviates the fixed wireless’ problem with the ability to transmit through obstacles but limited to by its range up to approximately 100ft.

Dubbed “Super Wifi”, white space has the advantages of transmitting broadband signals from three to seven miles¹⁵ out and through non-line-of sight obstacles.

Additionally it takes advantage of existing radio technology and repurposes the unused licensed television and radio frequencies to deliver broadband services. These unused frequencies are similar to what is used for 4G to deliver widespread broadband internet. With the switch from analog to digital signals by television networks in the United States, there are more available unused frequencies today. Being a regulated spectrum and reserved for television signals, the unused frequencies have to contend with less interference from devices such as microwaves or cordless phones.¹⁶ Furthermore, there is very limited need to excavate or determining if a site is clear of obstacles. This emerging technology has the potential to provide remote households and businesses alternative broadband options of while providing service providers a solution to deliver broadband services over great distances to more customers.

White space works by delivering wireless signals from an antenna (from a base station) to a terminal or receiver at the user end (home or business). At which point the receiver would convert the signal into broadband. The technology requires a receiver that can receive the frequencies and be able to identify the best frequency to broadcast the broadband signal to the broadband network.

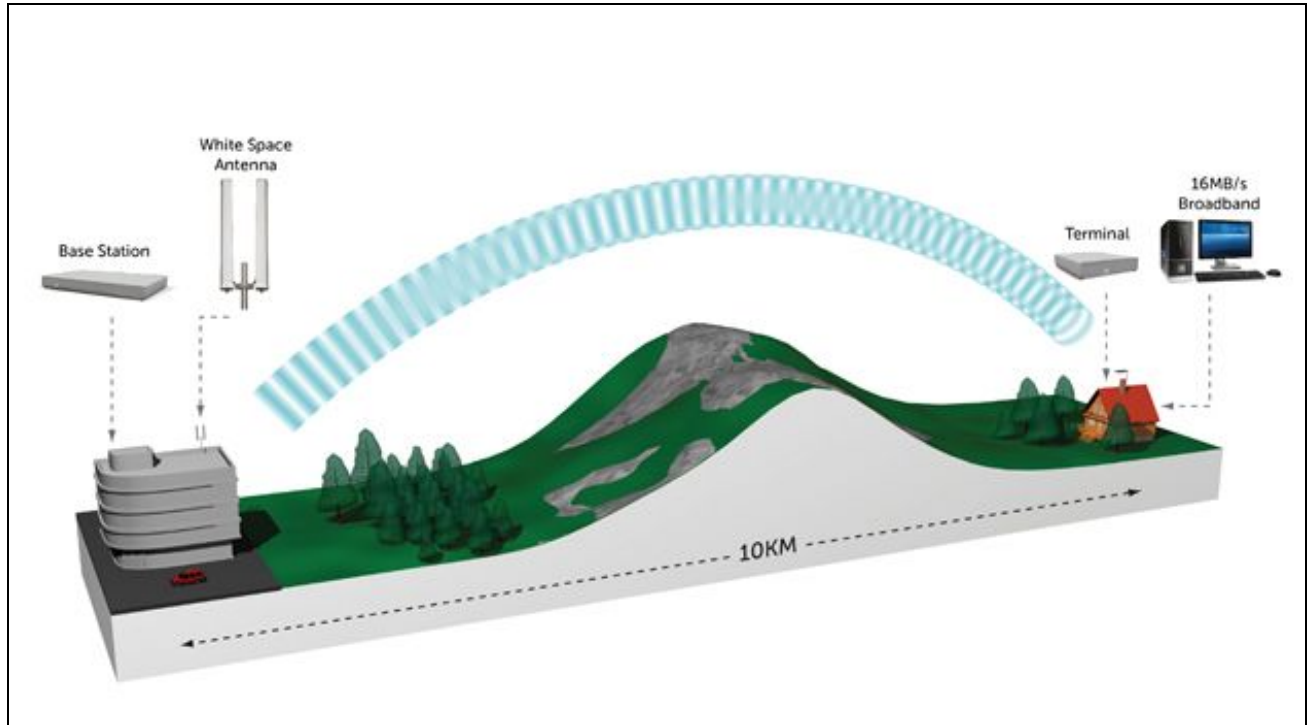
¹³ ibid.

¹⁴ibid.

¹⁵ "TV White Space Fact Page." Carlson Wireless Technologies. <https://www.carlsonwireless.com/tv-white-space>. Web. 1 Nov. 2017.

¹⁶ “Super' Wi-Fi could soon make it easier to get online.” The Mercury News. 30 Mar. 2017. <http://www.mercurynews.com/2017/03/30/super-wi-fi-may-finally-be-coming-your-way>. Web. 2 Nov. 2017.

Figure 5: White Space (Super Wifi) Diagram



Source: www.fiercewireless.com/

However, disadvantages of using white space are; 1) Depending on the availability of unused frequencies, the range of white space broadband can be limited. 2) The initial cost for a receiver can be steep. 3) White space provides broadband speeds but is slower than typical Wi-fi, cellular technology, and wired lines.

The technology is not readily available but many corporations such as Microsoft and Google have been researching this technology for years. Microsoft have piloted programs throughout the world including a successful pilot program in North Carolina.¹⁷

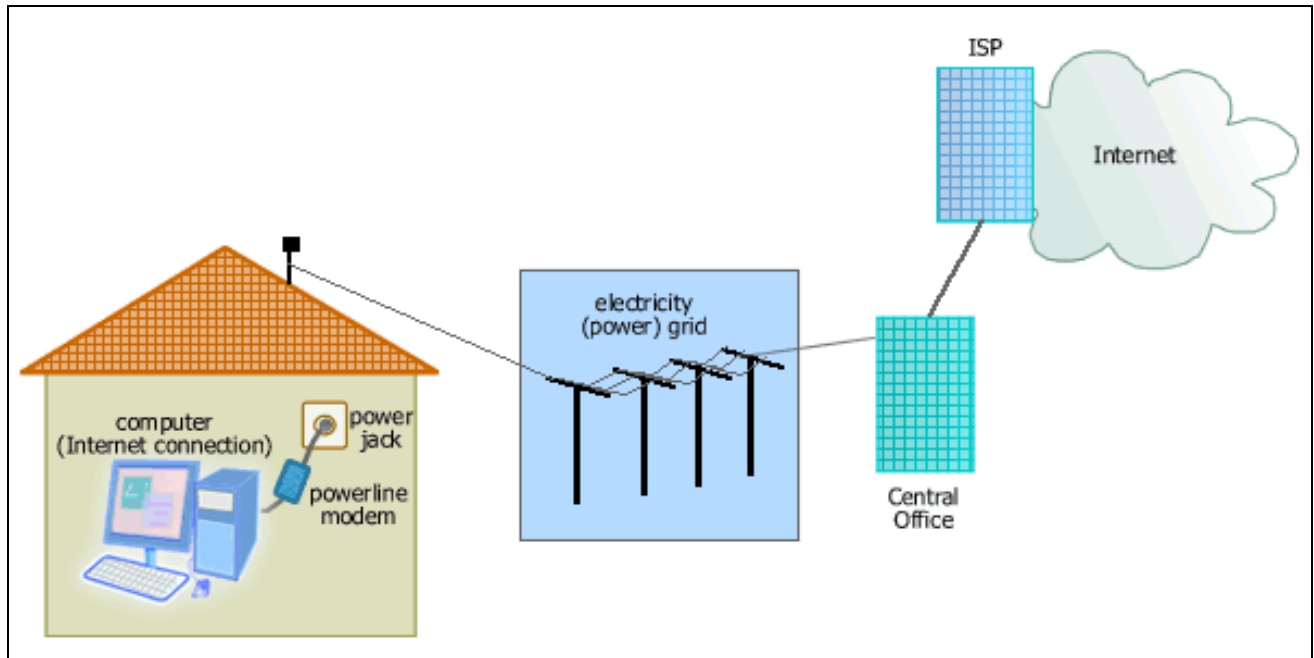
Broadband over Power Lines

Broadband over Power Lines or BPL leverages the extensive power line infrastructure providing electricity to every home and business. BPL transmit frequencies over power lines using adapters and repeaters (placed on the poles) to boost or strengthen signals over great distances. The signals are then hardwired or wirelessly transmitted to homes and businesses. Once connected to a power line provider all that is needed is a powerline modem which separates data signal from electricity.¹⁸

¹⁷ "Microsoft Whitespaces." <http://whitespaces.microsoftspectrum.com/>. Accessed 2 Nov. 2017.

¹⁸ "Powerline Broadband Internet In the United States" BroadbandNow.com. 24 Oct. 2016, <https://broadbandnow.com/Powerline>. Web. 2 Nov. 2017.

Figure 6: Broadband over Power Line Diagram



(Source: <http://www.conniq.com>)

Benefits of BPL is service providers can leverage existing infrastructure that already reaches millions of people. There is no need for capital investments to build an infrastructure therefore reducing their cost. The technology has been available over a decade and has since improved on the technology allowing for broadband speeds.

However, the power lines were not intended for uses other than electricity and did not incorporate a protective cover resulting in noise interference or unreliable signal strength for broadband service. Adaptors and repeaters need to be installed on poles to take advantage of the technology.

Many companies have taken advantage of this technology to provide internet access in some of the most remote areas in the world with power lines such as India. AT&T recently announced they have the technology to provide gigabit BPL broadband have been in development called Project AirGig with trials already in discussions with electric providers.¹⁹

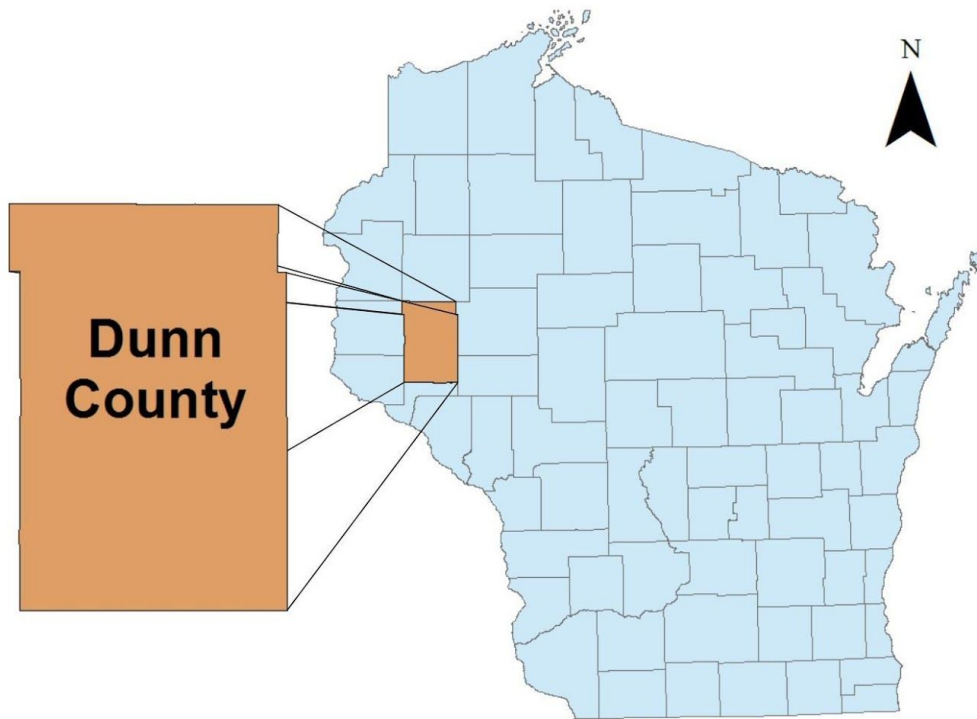
¹⁹ "AT&T plans to deliver fast Internet over power poles." USA Today, 31 Jan. 2017, <https://www.usatoday.com/story/tech/columnist/baig/2017/01/31/t-plans-deliver-fast-internet-over-power-poles/97260568/>. Web. 2 Nov. 2017.

Dunn County Overview

Regional Setting

Dunn County is located in west central Wisconsin and consists of 22 unincorporated towns, seven incorporated villages, and one city. The county seat is located in the city of Menomonie, which is also the largest municipality in the county. The county is bordered to the north by Polk and Barron Counties, to the east by Chippewa and Eau Claire Counties, to the south by Pepin County and to the west by Pierce and St. Croix Counties. Dunn County has a combined land and water area of approximately 553,252 acres, or roughly 864 square miles. It is rectangular and is about 24 miles east to west and 36 miles north to south.

Map 1: Dunn County

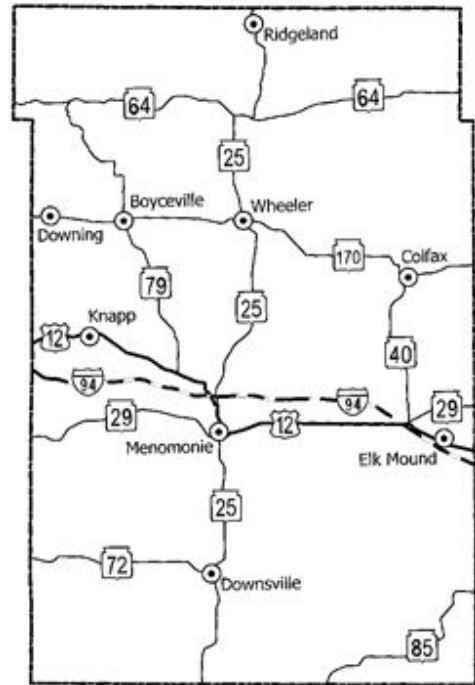


(Source: Dunn County)

Dunn County has a topography that ranges from flat and wide-open fields in the eastern areas to hilly and rough terrain in the west and northern areas. Glaciations and erosion has reduced the landscape to a nearly flat plain in eastern Dunn County with isolated remnants locally called “mounds”. Further west the landscape has more relief, the sandstone has been partially dissected by geologic erosion, and slopes are irregular and steep. The elevation ranges from 1000 to 1250 feet above sea level in the northern part of the county and from 750 to 1000 feet above sea level in the southern part of the county. Throughout most of the county, sandstone bedrock underlies unconsolidated soil deposits. The sandstone is underlain by crystalline rock such as granite. In the higher elevations of the western and southern portions of the county, the sandstone is capped by

dolomitic limestone. The depth to bedrock ranges from exposed bedrock and very thin soils (less than 22 inches thick) to deep soils greater than 100 feet in the pre-glacial valleys.

Dunn County contains several lakes, rivers, and streams with approximately 14 of the County’s 864 square miles being bodies of water. The Red Cedar River flows north-south through the county emptying into the Chippewa River, which flows along the southern portion of the county from east to west. The Eau Galle River flows north to south. There are three primary lakes in Dunn County, all man-made impoundments. Lake Eau Galle is located in the southern portion of the county in the Town of Eau Galle, Lake Menomin in the City of Menomonie, and Tainter Lake in the Towns of Tainter and Red Cedar. Elk Creek Lake is a smaller lake of 57 acres on the east side of the county that the Town of Spring Brook and Town of Union in Eau Claire County share. According to the Wisconsin DNR Wiscland study, Dunn County has the following land cover; Urban 0.5%, Agriculture 35.5%, Grassland 17.4%, Forest 37.4%, Water 1.4%, Wetland 7.5% and Shrubland 0.2%.²⁰



Dunn County’s economy is supported by a wide range of industries. The three largest industries in the county are the services (Professional/Educational, Entertainment/Other), retail trade, and manufacturing. The three largest employers in Dunn County are 3M, Walmart Distribution Center, and Mayo Clinic Health System-Red Cedar employing over 1000 people. The county was estimated to employ 22,270 people between 2011 and 2015. Furthermore, over 700 total acres of industrial park are available to support new businesses throughout the county.

A network of transportation services provide accessibility and transportation options throughout the county to businesses, villages and towns, and other destinations. The highway system consists of the interstate (I-94), US (12), state (29, 25, 72, 85, 64, 79, and 170), and county highways. I-94 divides the county in half and provides multiple interstate ramps along its entire Dunn County segment to many destinations. Airport services in Dunn County are available from the two municipal airports (in the City of Menomonie and Village of Boyceville), Regionally the County is served by the Chippewa Valley Regional Airport , twenty five miles to the east in Eau Claire County, and seventy five miles to the west is one of North America's busiest airports the Minneapolis-St. Paul International Airport. Two rail services serve Dunn County (the Canadian National and Union Pacific) connecting west central wisconsin to the Minneapolis-St Paul and Chicago areas. Additionally, bus services connect Dunn County to the Twin Cities and Madison areas via the Greyhound and Jefferson Lines.

Educational institutions provide the county with a pool of talent to support the industries. The University of Wisconsin-Stout is located in the City of Menomonie and is the only polytechnic university in the State of Wisconsin. It has a student population of 9,401 for the fall 2017 academic

²⁰ "Wisconsin Land Cover Data - "Wiscland"." *Dnr.wi.gov*. N.p., 2017. Web. 2017.

school year. Twenty miles to the east is the University of Wisconsin Eau Claire in the City of Eau Claire, and forty miles to the west is the University of Wisconsin-River Falls in St. Croix County. The Chippewa Valley Technological College is also located in the Cities of Menomonie (in Dunn County), Eau Claire, and Chippewa Falls. The Twin Cities is sixty miles to the west on I-94 providing direct access to the University of Minnesota-Twin Cities and an additional thirty public and private educational institutions²¹. The numbers of educational institutions and programs offered provide Dunn County with a wide range of skill set and education.

See Appendix A for a detailed Dunn County Economic Profile.

Demographics

Knowledge of demographics allows Dunn County to effectively plan for broadband usage and adoption. As demographics shift it is paramount that the county is prepared with a progressive yet flexible strategy to meet the expectations of the county's residents and businesses as well as its patrons regarding broadband needs.

According to the 2016 US Census²², Dunn County had a population of 44,704. The largest race in the county are white at 94.7%, followed by Asians (2.8%), and Hispanic and Latinos (1.9%). The median household income for Dunn County is \$49,788 and the per capita income is \$24,098; both lower than the state averages. The poverty rate for the county is higher than the state at 13.5% to 12.1%, respectively (see Table 4). The last census data (2010) with urban to rural populations indicated 40.0% lived in urbanized areas to 59.3% in rural. The City of Menomonie is the only incorporated municipality with an urban population, which represented 88% of the total urban population. The towns of Menomonie, Tainter, and Red Cedar make up the other 12% of the urban population. All towns with an urban population border the City of Menomonie. Table 5 below provides raw census data of the urban to rural populations.

²¹ Colleges & Universities In The Minneapolis/Saint Paul Metro Area." *Visit Twin Cities*. N.p., 2017, <http://visit-twincities.com/plan-your-visit/relocating-twin-cities/education/colleges-universities/>. Web. 16 Nov. 2017.

²² U.S. Census

Table 4: Dunn County and State of Wisconsin Demographics

Dunn County Census		Wisconsin Census	
Population (2016).....	44,704	Population (2016).....	5,778,708
Persons Under 5 years	5.2%	Persons Under 5 years	5.8%
Persons Under 18 years	19.7%	Persons Under 18 years	22.3%
Persons 65 years and over	15.6%	Persons 65 years and over	16.1%
Race and Hispanic Origin (2016)		Race and Hispanic Origin (2016)	
White	94.7%	White	87.5%
Black African	0.7%	Black African	6.6%
American Indian and Alaska Native	0.5%	American Indian and Alaska Native	1.1%
Asian	2.8%	Asian	2.8%
Two or More Races	1.3%	Two or More Races	1.9%
Hispanic or Latino	1.9%	Hispanic or Latino	6.7%
Median Household income (2011-2015)	\$49,788	Median Household income (2011-2015)	\$53,357
Per Capita income (2011-2015)	\$24,098	Per Capita income (2011-2015)	\$28,340
Persons in Poverty	13.5%	Persons in Poverty	12.1%
Average Travel Time to Work (minutes)	22.8	Average Travel Time to Work (minutes)	21.9
Population per square mile (2016)	52.6	Population per square mile (2016)	106.7
Business/Firms (2012)	3,256	Business/Firms (2012)	432,980
Firms Per Square Miles (2012)	3.8	Firms Per Square Miles (2012)	8.0

(Source: 2010 U.S. Census)

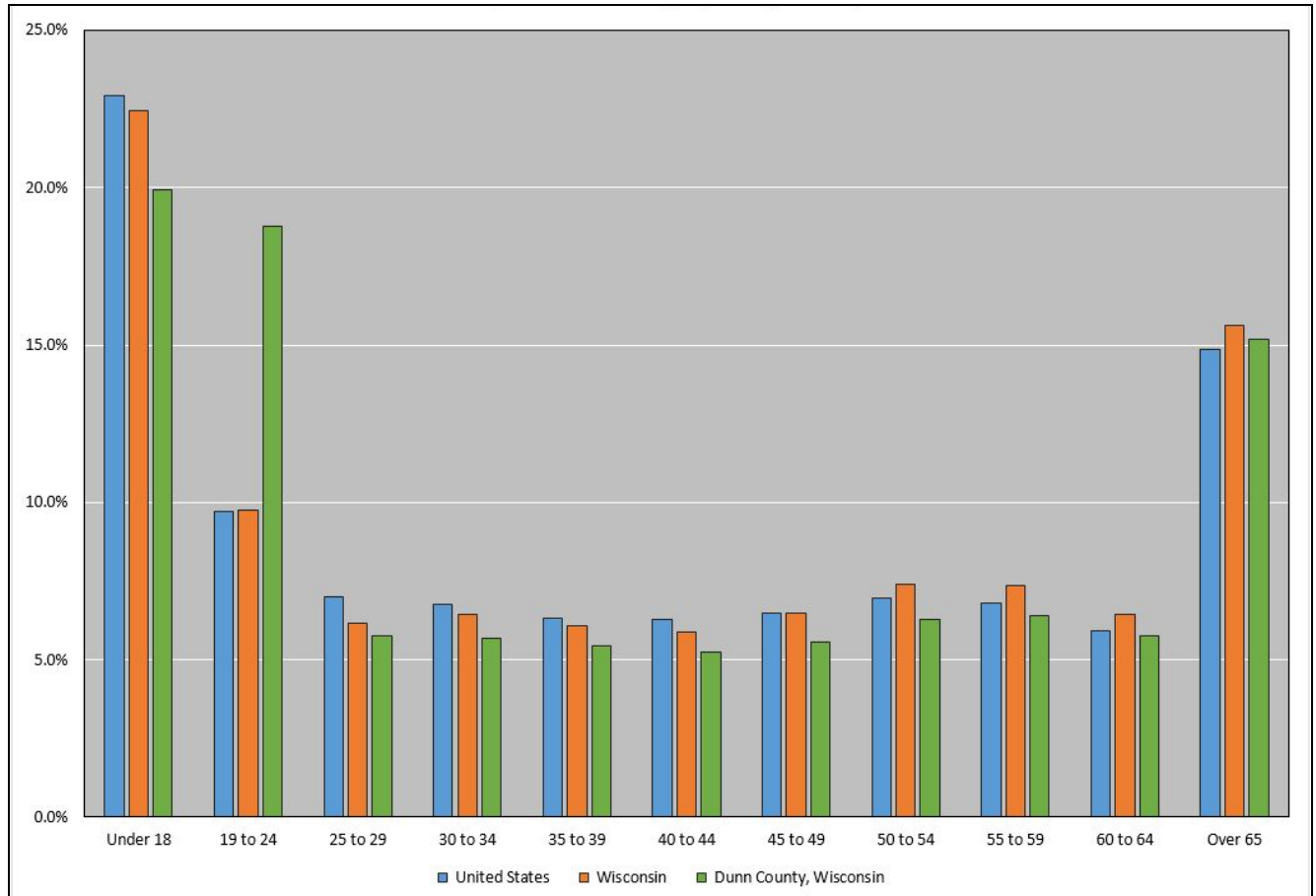
Table 5: Dunn County Urban and Rural Populations

	Total	Urban	Rural
Dunn County	43,857	17,844	26,013
Town of Colfax	1,186		1,186
Town of Dunn	1,524		1,524
Town of Eau Galle	757		757
Town of Elk Mound	1,792		1,792
Town of Grant	385		385
Town of Hay River	558		558
Town of Lucas	764		764
Town of Menomonie	3,366	1,036	2,330
Town of New Haven	677		677
Town of Otter Creek	501		501
Town of Peru	242		242
Town of Red Cedar	2,086	438	1,648
Town of Rock Creek	1,000		1,000
Town of Sand Creek	570		570
Town of Sheridan	454		454
Town of Sherman	849		849
Town of Spring Brook	1,558		1,558
Town of Stanton	791		791
Town of Tainter	2,319	717	1,602
Town of Tiffany	618		618
Town of Weston	594		594
Town of Wilson	531		531
Village of Boyceville	1,086		1,086
Village of Colfax	1,158		1,158
Village of Downing	265		265
Village of Elk Mound	878		878
Village of Knapp	463		463
Village of Ridgeland	273		273
Village of Wheeler	348		348
City of Menomonie	16,264	15,653	611

(Source: U.S, Census)

One interesting aspect of Dunn County’s demographic age group can be seen in Figure 7. The represented age groups are similar with one exception, the “19 to 24” age group for Dunn County. This age group is the result of Dunn County being the location of a 4-year university institution in the University of Wisconsin Stout Polytechnic. However, with such a high percentage in that age group it should also be noted that the following age group “25 to 29” is slightly lower than both the state and national average. It can be assumed that university graduates tend to leave Dunn County after completing their studies.

Figure 7: Age Group Demographics Comparison



(Source: 2015 U.S. Census)

Impacts of Broadband

Disruptive innovation is a term that describes a process by which an initial product or service of perceived lower quality aimed at a small segment of the market, which becomes mainstream or accessible from gradual improvements to eventually displace the established competitors.²³ More often than not, these established competitors take for granted these competitors due to their relatively small market share. Disruptive Technology is specific to technological advancements or innovations. There has been many disruptive innovations but the introduction of the internet in the 90's changed how the world communicated and has since led to many disruptive technologies.

Some examples of disruptive technologies as a result of the internet are:

Cell phones: The first available cell phones were developed as strictly a device for talking and were flawed with poor sound quality, expensive hardware, limited coverage area, and didn't offer much else compared to landline phones other than portability. Eventually sound quality improved, battery life improved, coverage area expanded, and new features were added (online capability, camera, GPS, etc.). It slowly gained customers beyond its established customer base with these gradual improvements. However, once the internet was integrated into cell phones (beyond just email) the cell phones gained popularity. Today the cellphone is referred to as a mobile device for its all-in-one tool on the go.

Netflix: Blockbuster was a nationally recognized premier video rental businesses in the 90's before the rise of on-demand streaming services. When Netflix first arrived to compete against Blockbuster and the video rental industry, their model focused on rental delivery to your door and older movies. The traditional video rental industry held onto their customers who wanted new releases, while Netflix attracted casual moviegoers and movie buffs who didn't mind the delivery wait and older selection. Eventually Netflix combined streaming movies with their services and gradually increased their movie library. Along with shifting preference to online services and increased broadband bandwidth to stream movies, Netflix became the premier video streaming service while Blockbuster, along with the video rental bigbox platform, has become a 90's icon of what was.

The examples are changes where technology gradually improved along with meeting changing needs. The internet has influenced how the world operates by encouraging innovative processes. The County believes this disruption will benefit the county greatly by allowing far greater access to resources and opportunities for our residents and businesses with a forward thinking approach to have broadband access to all households and businesses.

The next sections discuss how the internet, as a disruptive technology, has or can positively impact various aspects of Dunn County and our residents and businesses.

²³ "Disruptive Innovation." Clayton Christensen. <http://www.claytonchristensen.com/key-concepts/>. Web. 28 Sep. 2017.

Government Transparency and Public Engagement

Technology has provided many benefits for social and government programs to deliver services to all demographics and populations across large areas. The cost of delivering services is rising and rural areas often can be negatively affected with the added cost to provide services for these low population, especially with a rural county such as Dunn County. The internet has become a very important tool for rural interactions .

The ability to access information and the delivery of services from libraries/information resources, health care systems, education systems, and from the comfort of resident's homes has become a huge benefit of the internet, by providing a technology that has increased innovation and created new channels for delivering service to citizens. The technology has offered citizens the benefit of extended business hours, communication/interaction, flexibility, and access to knowledge.

The most basic web pages can provide information on process and contact information but they can also provide a mechanisms for governments to provide services that support community engagement. As the demand for more transparency and self directed access to information increases there is an opportunity for governments to effectively and easily inform the public using multiple online platforms.

Online platforms and software are:

- 1) Online forms/applications processing (building and zoning permits,, etc.), and payments.
- 2) Mapping tools provide citizens easy access to public information such as property information, public land, environmentally sensitive areas (wetlands, flood areas),, and other Municipal activities. By leveraging mapping tools in conjunction with applications such as zoning and building permits, local government can reduce the time that office staff need to interact with residents.
- 3) Video applications has also increased in popularity. webcasts can transmit live Board Meetings, committee meetings, public activities and other local events. These events can be stored in a video format and viewed by citizens in the comfort of their home, etc.
- 4) A navigable government website allows residents to easily find information on departments, committees, and general government information (events, meeting minutes, and public forums).

With greater transparency and access to information, it is expected that an informed public will result in a more active public engagement in government. Many committees, subcommittees, and public hearings could benefit from public engagement and comments, to develop better policies and programs. With multiple platforms (such as forums, comment areas, and direct contact) the public could have multiple methods of engaging the government.

In order to deliver such services effectively to our residents they must have access to high speed broadband services, not just internet access. Attempting to deliver data-intensive services such as video and maps is too inefficient on non-broadband internet services. Speed is important because load times greater than 10 seconds often result in users leaving the site, and if a user does stay,

repeatedly slow load times can create an unpleasant experience.²⁴ An enjoyable experience by a residential user may result in accessing additional information and becoming more informed.

Healthcare

The health care services will be a major beneficiary of rural broadband expansion. The ability to access critical health files, x-rays, images, and conduct live one-on-one video conference consultation between a practitioner and patients in separate locations is a desired and growing service in the medical industry. Combine such opportunities with the ability for medical personnel to interact with patients in their homes has the potential to greatly improve health care services by reducing unnecessary visits to emergency rooms and clinics, and servicing patients without access to transportation and mobility issues.

These services are desirable in rural and remote areas where the distances for a practitioner or patient to travel can be an hour or longer. The reduction in travel time could result in direct savings (such as gas, additional medical equipments, etc) as well as the benefit of improving the quality and speed of services. A practitioner could visit with more patients over a video conference as opposed to travelling to individual homes, thus more patients would be serviced without increasing staff. Patients can receive faster consultation and improved patient satisfaction.

Public Safety and Emergency Response

Broadband technologies will give first responders a tool to save lives. Developing an infrastructure that can effectively support first responders is important in the safety of all stakeholders in the county and throughout the nation. Wireless broadband network allows first responders the tools to effectively communicate with one another and the patient at all times and with limited delay. This is especially beneficial during major catastrophic events where having a dedicated network can provide first responders access to an uninterrupted and low traffic network.

Education

The internet has always been a powerful tool for online education and accessing information. The benefits of online education include all ages from k to 12 education, postsecondary education and beyond into lifelong learning opportunities. Internet connectivity has the flexibility to be used in a group/classroom setting or in an individual setting. While schools could benefit from interactions with students in different parts of the country/world, individuals can earn degrees; engage in new skills development or other personal interests' development. The internet can be used at many speeds to deliver different types of learning mediums, however, it is most effective as a video or streaming video conference, thus broadband access (speeds of 25Mbps) is essential in effectively delivering educational content due to the intensive data requirements of video streaming.

²⁴ Nielson, Jakob. "Website Response Times." Nielsen Norman Group. 21 June 2010, <https://www.nngroup.com/articles/website-response-times>. Web. 28 Sep. 2017.

Economic

Across the board studies measuring the extent of broadband's economic impact on local economies show that it has a far and wide impact on all industries. Virtually all of the studies conclude there is a definable benefit to deploying broadband networks and enabling new services and applications to businesses and customers. The internet has opened up a path of creativity for innovation across all economic sectors and broadband will positively impact economic development with innovation and limitless potential

The reliance on the internet and web-based tools and application have become the de facto form of communications leading into the 21st Century where just two decades ago the telephone and postal services were the preferred forms of communication. It is evident that this reliance on online services and tools has been essential to small business and entrepreneurs finding success Being connected to the internet allows for all businesses, new and old, to take advantage of web-based tools. Being online allows for businesses to order supplies, communicate with customers and clients, and market their services and products. It has replaced the need for phonebooks, supply catalogs, and physical retail/product space. Businesses and entrepreneurs have the ability to easily market their product or carve out a niche utilizing web tools and social media and networking. Some of these businesses that have grown out of this space of the internet are:

Amazon is a great example of how a company can take advantage of the internet interactions for consumers using online purchasing. They started with books and now sell everything from books, music, toiletries, groceries/food products, etc. They not only allow shoppers to browse the products but they offer ratings from industry sources and other consumers. They enable the shipment of the desired products and integrated Paypal as a popular online secure payment method (Amazon now offers their own online payment methods in addition to Paypal).

Paypal is another niche market that has grown into a multi-billion dollar company as an online transferring bank. When it started in 1998 it was known as Confinity, later it would merge with X.com and be rebranded to PayPal. It allows for consumers and sellers to make online transactions without having to use a credit card. At one time PayPal was exclusive to Ebay, but today can also be found on some of the largest online retailers. BillPay, Google Pay, and Amazon Pay are all the results of PayPal.

Online crowdfunding (such as Indiegogo and Kickstarter) has become a niche in providing a method of getting products out of the design stage and into production. They have help create an affordable 3D printing niche supported by the online open source with free programs to get the average person printing without much knowledge. Since Kickstarter's debut, it has provided board and card games a medium to promote and fund their projects with a 93% success rate totaling \$196 million compared to 85% success rate for video game projects (including hardware and mobile games) totaling \$179 million²⁵. Online

²⁵ "Crowdfunding Is Driving A \$196 Million Board Game Renaissance." FiveThirtyEight. 18 Aug. 2015, <https://fivethirtyeight.com/features/crowdfunding-is-driving-a-196-million-board-game-renaissance>. Web. 13 Sep. 2017.

crowdfunding has allowed hobbyist to become entrepreneurs filling and creating new niches and businesses.

Connectivity is more vital than ever as society move away from physical tangible interactions to less tangible forms. Online applications, portals, and cloud storage (replacing paper documents, service desks, and hard drives) is now commonplace, and expected by customers.

This enables customers to receive an order, confirm it and negotiate delivery without ever having to talk to with a representative or waiting in line. While this may not seem like the main method of interaction, younger generations (iGen) will easily accept these types of interaction as the generation who is up on high tech devices (smartphones, tablets, etc) and internet connectivity (youtube, netflix, instagram, etc).

The use of avatars, virtual rooms/offices, financial transactions, and information storage have shifted from central servers located on the premise to off the premise and often managed by an outside source. Small businesses today have less disadvantages than large firms with its economical footings. As businesses continue to integrate online and take advantage of its greatest feature as a tool for communication and collaborations, such tools as peer-to-peer networking (P2P) become more important. With P2P networking, a network connected globally will be critical to increase participation. The internet has provided a tool for the public to easily interact with one another, and by developing additional tools to support these interactions such as Craigslist or AirBnB it has allowed for even greater innovations and opportunities from entrepreneurs.

One of the benefits of the internet is, local but global. To continue supporting the local community but being able to access a global market with developing an online presence be it a professional website or utilizing tools such as Ebay, businesses should not be precluded or disadvantaged based on their rural locations.

The belief is that rural businesses tend to support the community they are in and can consist of their entire customer base. Rural businesses are just as varied as urban businesses and include manufacturing, retail, services, and agriculture. The onset of the internet allowed many of these business to adapt and leverage the benefits that come with online access. Some of the significant disadvantages of rural businesses (as compared to urban businesses) is 1) access to the broadband (25Mbps/3Mbps), 2) high speed and 3) affordable price according to the 2010 Small Business Administration (SBA)²⁶. While the average cost of internet services between rural and urban businesses were \$93 and \$115, respectively in 2010, the cost of comparable speeds for rural businesses were much higher than its urban businesses²⁷. The disadvantages have not dissuade rural businesses from adopting the broadband where it is available. Table 6 identifies the impact that broadband networks can have on businesses.

²⁶ Columbia Telecommunications Corporation. *The Impact Of Broadband Speed And Price On Small Business*. Small Business Administration, 2010. Print.

²⁷ *ibid.*

Table 6: Broadband Networks Impacts on Businesses

EFFECT	DESCRIPTION	EMPLOYMENT EXAMPLES
Productivity	Improvement of productivity as a result of adoption of more efficient business processes enabled by broadband.	<ul style="list-style-type: none"> ● Marketing of excess inventories ● Optimization of supply chains
Innovation	Acceleration of innovation resulting from the introduction of new broadband-enabled applications and services.	<ul style="list-style-type: none"> ● New applications and services (telemedicine, e-commerce, online education, video on demand (VOD) and social networking) ● New forms of commerce and financial intermediation
Value Chain Recomposition	Attract employment from other regions as a result of the ability to process information and provide services remotely.	<ul style="list-style-type: none"> ● Outsourcing of services ● Virtual call centers ● Core economic development clusters

(Source: Broadband Stimulus in the Economy, Dr. R. Katz, May 2009)

The main cause for concern is that rural areas have insufficient access to broadband (minimum of 24 Mbps download speeds) from a lack of infrastructure. Table 7 indicates there are indirect impacts related to the presence of broadband infrastructure but difficult to quantify. Studies have deduced that areas of high penetration of broadband have more economic activity as a result of broadband infrastructure and the enabled applications.

Table 7: Indirect Impacts of Broadband Infrastructure on the Economy

	High Penetrated Regions	Low Penetrated Regions
Impact on GDP growth	Very high in the short term and reducing over time.	<ul style="list-style-type: none"> • Lower than high penetrated areas in the short term but catching up to a similar level as highly penetrated areas.
Impact on employment	Very high in the short term and reducing over time.	<ul style="list-style-type: none"> • Positive although with low significance.
Implications	<ul style="list-style-type: none"> • An increase in broadband penetration in highly penetrated areas has a strong impact because the economy is so developed that it can immediately utilize the newly deployed technology. • The fact that employment and GDP grow in parallel indicate that broadband is having a significant impact on innovation and business growth to overcome any employment reduction resulting from productivity effects. 	<ul style="list-style-type: none"> • In low penetrated areas, the increase in broadband penetration takes longer to materialize in economic growth because the economy requires a longer period of time to develop and fully utilized the technology. • However, after three years the level of impact of broadband in penetrated regions is as high as in high penetrated areas. • The fact that employment growth is negative indicates that productivity increase is the most important network effect at work, resulting in employment reduction.

(Source: Broadband Stimulus in the Economy, Dr. R. Katz, May 2009)

Other countries and regions around the globe have significantly more infrastructure and connectivity services at lower costs than the United States. “Countries such as Japan, Singapore, South Korea, and Sweden are making innovative Web-based applications and services in business management, business models, research applications, telecommuting, telemedicine, public safety, education, and entertainment which simply are not possible in many areas of the United States, which is cause for concern.”²⁸ Dunn County can position itself to provide a quality of life comparable to these countries by investing in broadband expansion, otherwise the county’s potential in its residents and businesses will remain dormant.

²⁸ Ezell, Stephen J. et al. "The Need For Speed: The Importance Of Next-Generation Broadband Networks." SSRN Electronic Journal (2009): n. pag. Web.

Dunn County Internet Service Providers

There are several internet service providers or ISP's (service providers) offering a wide range of services in Dunn County. The following provide internet access in Dunn County:

- 24/7 & West Wisconsin Telcom
- AT&T
- Baldwin Lightspeed
- Bloomer Telephone Company
- CenturyLink
- Charter Spectrum
- Exede
- Hughes Net
- Mosaic Telecom
- Nextgen
- Ntec
- Verizon Wireless

The service providers listed above offer a range of services as described in the Broadband Technologies section. Most of these service providers offer comparable packages or service offerings depending on their infrastructure. Since hotspot services run off of cell towers, coverage is comparable to cell phone coverage and susceptible to data areas or weak signals. However, a hotspot devices can quickly be acquired by visiting a local cell phone retailer with similar contract terms as a cell phone but most likely be data capped.

Incumbent Local Exchange Carrier and Competitive Local Exchange Carrier

In order to understand how service providers operate a brief history of "Incumbent Local Exchange Carrier" (ILEC) and "Competitive Local Exchange Carrier" (CLEC) must be understood. The Telecommunications Act of 1996 was the first major overhaul of telecommunications law in almost 62 years²⁹ which supported the creation of new service providers. The act came a decade after the official break up of the telecommunication monopoly of AT&T and Regional Bell Operating Systems into smaller companies (called "Baby Bells") on January 1st, 1984. The act made it easier for new communications businesses to increase competition which led to the formation of ILEC and CLEC.

1. The ILEC are the original telephone company providing local telephone service. They own most of the built infrastructures and facilities in service area. Territories divided among the ILEC governing who had the rights to operate in them. (AT&T is an example of an ILEC.)
2. The Act of 1996 opened up the ILEC territories and infrastructures to be used by CLEC. CLEC's rent infrastructures or areas from the ILEC in order to operate within that territory.

²⁹ "Telecommunications Act of 1996." Federal Communications Commission. 20 Jun. 2013. <https://www.fcc.gov/general/telecommunications-act-1996>. Web. 26 Sep. 2017.

The ILEC and CLEC are constantly in competition; and different laws and rules govern each.

Broadband Expansion Grants

The state has allocated funds into a Broadband Expansion Grant Program with a goal “to encourage the deployment of advanced telecommunications capability in underserved areas of the state.”³⁰ The program is an effort for the state, as a whole, to support broadband expansion to all reaches of the county. A recent Federal Communications Commission report found 13% of Wisconsin’s population (744,002 people) lack access to at least one broadband service, compared to the national average of 10%. Comparing populations living in rural census blocks, 43% of Wisconsin residents lack access to at least one broadband (710,485 people) compared to the national average of 39%.³¹

Since the addition of the Broadband Expansion Grant Program in the 2013-15 biennial state budget with a funding of \$500,000 annually, it has increased with each biennial budget since. The grant funding increased to \$1.5 million for the 2015-17 state budget and \$7.5 million for the 2017-19 state budget.

Open Submittal Period

The grant program open submittal is determined by the Public Service Commission (PSC) and is announced via their website (<https://psc.wi.gov/>), Twitter feed ([@WI_Broadband](#)), and email.

After the close of the open submittal period the PSC allows for a public comments period for 14 days. Comments are recorded as part of the submitted applications. PSC staff then provides a brief memorandum specific to concerns based on the public comments impacting the evaluation of the individual application.

With the passing of the 2017-19 state budget, a second round of FY 2018 grants was opened by the PSC. Applications are accepted starting October 11, 2017 with a deadline of January 25, 2018. Moving forward, the Broadband Expansion Grants deadline is anticipated to have a recurring June deadline. (See Appendix B for PSC Broadband Expansion Grant Letter)

Program Eligibility

For Program Eligibility requirements see (Wis. Stat. § 196.504 (1)) For additional Broadband Expansion information visit the PSC website at:

<https://psc.wi.gov/Pages/Programs/BroadbandGrants.aspx>

³⁰ “Frequently Asked Questions regarding the Broadband Expansion Grant Program.” Public Service Commission of Wisconsin. 2017. Print.

³¹ *ibid.*

Dunn County Rural Broadband Study

Dunn County, as a very rural county, has an opportunity to leverage and position the county with county-wide broadband connectivity. Just having connectivity to the internet is not enough due to variability in connection speeds and reliability. In order to prepare for the future “broadband speeds” (as defined by the FCC’s 25Mbps download/3Mbps upload) is necessary to provide all county residents and businesses with the equivalent speeds of those in urban areas and globally.

Resolution 58

With increased interest in rural broadband, June 15 2016 the Dunn County Board of Supervisors (Board) passed Resolution 58 (see Appendix C) committing “to strengthening and maintaining broadband infrastructure throughout Dunn County at levels that allows for education, business and industry to compete on a global level, based on data capacity, speed and adoption.”³² The resolution became a catalyst for the service provider 24-7/West Wisconsin Telcom to expand fiber broadband to the unincorporated Village of Rusk in the Town of Red Cedar. On the heels of the Rusk fiber expansion project, the Community Resources & Tourism Committee (CR&T) decided to form a study team (Team) to conduct a broadband Gap Analysis as a means to better understand rural broadband expansion. The Team included representatives from; University of Wisconsin-Extension, Dunn County Planning and Zoning Division, and Dunn County Economic Development Corporation . The Team was tasked with all aspects of the broadband gap analysis and to full report. The final report was presented to the Board in the spring of 2018.

Methodology

The study was broken into two phases, community outreach and data and needs assessment where information was collected via a comprehensive broadband survey. The Survey data was sent to the University of River Falls - Survey Research Center for a complete analysis and a full report including findings.

Phase I - Community Outreach

In this phase the team conducted four public Community Conversation (open house) events informing residents and businesses owners about the broadband study and provided opportunities for the community to ask questions and voice their concerns.

The community conversations were held on the following dates:

1. April 6th at the Dunn County Community Services Building in the City of Menomonie.
2. May 23th at the Tiffany Creek Elementary School in the Village of Boyceville.
3. June 19th at the Colfax High School in the Village of Colfax.

³² Wathke, A. Julie. *Board of Supervisors Official Proceedings 2016*. Dunn County, WI. Print.

4. October 30th presentation to senior citizens and community members at the Shirley Doane Senior Center.

Each event lasted approximately 1.5 hours and attendees consisted of a mix of residents, businesses owners, service providers and State representatives. Phase I purposely overlapped Phase II in order to accommodate Town and Village meetings. In the end The Team facilitated conversations with all twenty-two (22) Towns and six of the seven (7) Villages.

Prior to holding these Community Conversations the Team wanted to meet with all of the service providers operating in the County to gain their input, however, due to scheduling conflicts only three of the local service providers (WWT/24-7, CenturyLink, and Mosaic) were able to meet with the Team. At these meetings they shared with the Team a generalized outline of their capacity to support internet access in the county. which included providing good customer services and expanding broadband into new areas.

A future community conversation date will be determined after the final report has been accepted by the Board. The purpose of this community conversation is to present the report and findings to the general public.

Phase II - Data and Needs Assessment

In this phase a significant amount of data was needed to assess the county's broadband needs. Data came mostly from two sources, researching articles and publications and through a survey. The survey was developed in house and went live on June 20th, it closed on July 21st. In order to get as complete an assessment as possible the survey was available to all residents (City, Village and Town) within the County. In an effort to reach as many residents as possible and to make "responding to the survey easy and convenient," respondents were given the following options for completing the survey:

1. Online.
2. Optimized for mobile phones, via a QR code
3. Hardcopies were made available at:
 - a. UW-Extension Office
 - b. Dunn County Government Center
 - c. All village and town halls
 - d. All public libraries
 - e. Farm Service Agency (FSA)-US Department of Agriculture.
 - f. Dunn County Job Center
 - g. Chippewa Valley Technical College (CVTC)- Menomonie Campus

As a means to raise the awareness of the upcoming survey and to (hopefully) increase its participation rate, the Team implemented the following marketing plan:

1. Postcard were mailed to all residential addresses in Dunn County two weeks before the survey went live.
2. Posted announcements on the Dunn County, UW-Extension, and Dunn County Economic Development websites.
3. Posted flyers in areas of high-traffic such as: grocery stores, Town and Village public notice boards, gas stations, schools, Dunn County Job Center, and CVTC.

- 4. Posted announcements on social media and networking sites such as Facebook.
- 5. Word of mouth.

The broadband survey had a very good response rate (see Chart 1) from both the residences and businesses in Dunn County.

Chart 1: Dunn County Broadband Survey Responses

Survey	Total Responses	Response Rate
Residential	16,600	10.4%
Businesses	1,110	9.2%

(Source: Dunn County)

At the conclusion of the survey, the statistical software Qualtrics was used to conduct a simple in house assessment of the survey data. Afterwards the data was sent to the University of River Falls - Survey Research Center for further analysis.

Survey Analysis

The University of River Falls - Survey Research Center (SRC) provided an analysis of the broadband survey. The SRC performed cross-tabulations (a technique using multiple responses to identify relationships) from the responses. In addition to cross-tabulation a written analysis and maps were provided to the Team as a report.

The Team reviewed the report and synthesized out key findings which are listed below. (The full survey can be found at the following website: <http://bit.ly/2E3ni11>.)

Residential Responses

Residential Respondents with Internet Service

Internet service options are not distributed evenly across the county. DSL is the most widely available service options with a response rate of 32%, followed by cable modem (27%), and wireless (21%) as the three most used service.

Less than 50% of residents are satisfied with their internet service. This is especially true of Towns with limited access to the internet such as Lucas, Hay River, and Sherman where each town have greater than 75% of their residences slightly or more dissatisfied with their internet service and almost half (44%) of respondents are without any internet access.

Residential Broadband Service Fee

Just over half (52%) of residential responses currently with internet services prefer to pay less than \$50 per month for broadband service. Similarly, half (50%) of residences without internet access prefer to pay less than \$50 for broadband services. However, Towns with high dissatisfaction levels (such as Lucas, Hay River, and Sherman) are willing to pay more than \$50 for similar services. Additionally, Towns of non-scribers were not statistically significant at the 0.05% level suggesting broadband service cost is less of an issue further supporting the higher respondents willing to pay more.

Residential Non-subscribers

Four out of five (78%) residential respondents indicated that “no internet access” is the primary reason they do not have internet service. Towns with high responses of “no internet access” also had high residential dissatisfaction with their internet service.

Home Businesses and Telecommuting

Approximately one in six (17%) of residents with internet service currently have a home business and one in five (21%) currently telecommute from home. While one in five (20%) residents with

internet service are interested in operating a home business. One In four (23%) indicated they would telecommute if they had broadband access. Most of those interested in starting or growing a home businesses and/or telecommuting were from Towns with high levels of dissatisfaction, suggesting unreliable and slow internet may be the roadblock.

Residences without internet service have a higher response rate than those with service regarding starting a new home business (36%) and/or telecommuting (42%). However, if residences with service are combined with those who already have a home businesses or telecommute with those who would consider starting a home business, the data is comparable (Home businesses 37% and telecommute 44%).

Business Responses

Business Ownership

A large majority, own their business location (82%), while 12% rent, and 6% have different arrangement.

Business Access

Nearly three-fourths of business respondents (72%) said they have internet service.

Though the numbers of businesses respondents is much smaller than the residential respondents, there is a pattern of fewer business in areas with limited or non-existent internet service, which is similar to the residential summary (e.g. Lucas, Red Cedar and Sherman).

Business Satisfaction

A larger proportion of businesses respondents expressed levels of dissatisfaction rather than satisfaction. Nearly a third of respondents (31%) are extremely dissatisfied, while one in four (24%) are moderately dissatisfied with their internet service. On the other end of the scale, one in ten (10%) respondents are extremely satisfied with their Internet service, and 17% are moderately satisfied. Taken together, 55% of business respondents are dissatisfied to some degree. Business dissatisfaction (55%) with internet is slightly higher than residential dissatisfaction (54%). Those who are satisfied to some degree comprise 40% of the responses, with the largest percentage being moderately satisfied.

Business Growth

Three-fourths (75%) of business subscribers have had internet service for at least six years. 8% of respondents have had internet service for at least three years and less than six years. 14% have had internet for at least one year and less than three years. Only 3% are relatively new (less than one year).

Business Non-Subscribers

The largest proportion of respondents said they don’t have internet service at their business because it is not available at their location (85%). Only 4% said that cost was a limiting factor while 8% said they aren’t sure why they’ve not subscribed to an internet service.

Relocating Out of the County

One in five business respondents (21%) said they had considered moving their business out of Dunn County. The numbers are small, but there appears to be higher proportions of businesses who’ve considered relocating out of Dunn County in many of the same Towns in which residents expressed higher levels of dissatisfaction with internet service (Lucas, Red Cedar, Sherman).

Open Ended Survey Comments

In addition to the formatted answers of a particular survey question most questions also had an area for comments. Tables 8 and 9 below summarize comments by type of response and topic, percentages are sorted in descending order.

Table 8: Open ended Residential Survey Response Summary

Residential Responses		
Topic	Count	Percent
Speed and Reliability	265	28%
Broadband Availability/Accessibility	218	23%
Price and Affordability	174	18%
Broadband Choices and Competition	170	18%
Provider Specific	29	3%
Miscellaneous	91	10%
Total	947	100%

(Source: Dunn County Broadband Survey Report)

Table 9: Open ended Business Survey Responses Summary

Business Responses		
Topic	Count	Percent
Speed and Reliability	22	42%
Broadband Availability/Accessibility	12	23%
Price and Affordability	7	13%
Broadband Choices and Competition	5	10%
Miscellaneous	6	12%
Total	52	100%

(Source: Dunn County Broadband Survey Report)

Residential Survey Open Ended Comments

“Broadband is critically important to economic development, social equity and individual participation in civic life. We need to find a way to insure that address does not inhibit access.”

Everything we do, including education, relies so much on the availability of the internet. I really hope something can be done to allow the residents of Dunn Co. the opportunity to live within the 21st century.”

“It is unfair we have to pay more for less in rural areas to have what has become what is necessary to stay competitive in work, school and business.”

“It would be nice to have other options available if you are unhappy with current subscriber whether it be speed, cost, or general satisfaction.”

Business Survey Open Ended Comments

“The speed of my current internet is slow and it varies from time to time. Sometimes it uploads faster and other times it is quite slow. I worked for a business in Eau Claire up to five years ago and the speed of our internet is very slow in comparison. I assume it is because we live/work in a rural area.”

“I currently run two businesses in Dunn County with a plan to start a third. I am now at a point that I cannot continue these businesses. I am falling behind in my IT capability to meet client demands. I am currently looking to move out of Dunn County. Even if I pay enormous amounts for satellite internet, this capability does not allow for the video conferencing and large data demands of the business.”

“I have a real estate development at [REDACTED]. I have lost sales because broadband was not available there. People with home businesses have bought elsewhere because broadband is not available there. This has hurt my ability to make sales that were all but done and some backed out.”

“We need universal broadband because of the advantages it gives businesses and because competing businesses continue to be severely disadvantaged without it.”

“I have a fiber optics line at my Ridgeland office. Here in Red Cedar I have to rely on a Verizon hotspot which is frustrating with expensive, limited capacity, and speed. We cannot get AT&T or 24-7 because of "licensing agreements". I am jealous of my more rural friends who have high speed internet and TV cable.”

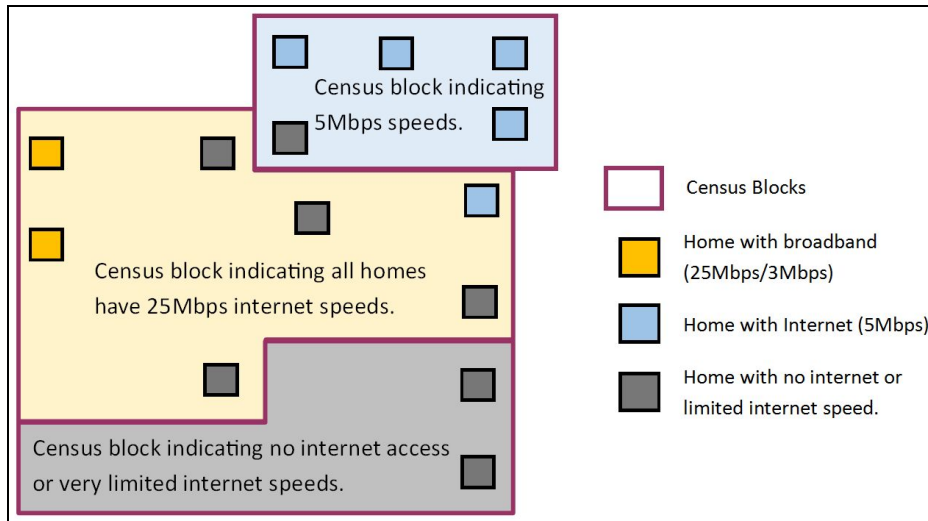
“\$1,000 per month is too much for fiber for a home based business, but only decent quality option.”

Survey Map Analysis

An important service provided by SRC was the creation of maps using the survey answers to provide a spatial analysis of the county’s broadband gaps. These maps provide another set of maps, in addition to the PSC maps (see Appendix D or visit the PSC website <https://maps.psc.wi.gov/apps/WisconsinBroadbandMap/>). Because the PSC’s maps use census blocks to determine where internet speeds throughout the county they do not accurately represent the broadband gaps in the county.

Census blocks are geographical units that are defined by using visible (roads, rivers, lakes, etc) and invisible (city and county lines, property lines, school districts, etc) characteristics of the land, which in turn are used by the US Census Bureau for its tabulation of US data (such as age, housing, etc.). Census blocks may be large or small and irregular in shape. The PSC maps used these census blocks to determine the highest internet speeds in the entire block. If one end of the block has fiber optic wire and broadband speeds while the opposite end of the block has no access to the internet the PSC maps show that everyone has high speed internet.

Table 10: Example of Census Blocks and PSC Internet Speeds Coding



The SRC maps present a different approach by using approximate locations through the survey responses. This method should provide a better representation of the type of internet access residents and businesses actually have, rather than grouping everyone into a block and identifying the block with the fastest speeds.

Not all survey questions were mapped. Further spatial analysis of maps need additional data and/or analytical programs.

SRC maps for both the Residential and Business surveys can be found in Appendix E to Appendix O.

Residential Map Analysis

A comparison of the PSC Connectivity Map (Appendix D) shows that areas with slow speeds of 3Mbps/0.768 Mbps has a correlation with the SRC Residential Access to Broadband map (Appendix E) of respondents without internet. The PSC map shows connectivity throughout many parts of the county due to its inclusion of fixed wireless and satellite services, however, these areas provide fairly slow speeds often not meeting the broadband speed criteria. The omission of fixed wireless and satellite services from the PSC map show a similar gap of areas without internet connectivity to the SRC map. Internet connectivity around the city and villages are fairly well connected.

Another interesting observation is that within the city limit it is well serviced, however, outside the city there are limited to no internet connectivity for a few miles before internet connectivity increases. This creates a donut effect where those in the center (City of Menomonie), the first ring, are well served, while the secondary ring has limited to no internet connectivity, with the outer third ring again indicating residents with access to the internet. Both the PSC Connectivity map and the SRC Access to Broadband map show this effect.

Analyzing the satisfaction levels (Appendix F) of residences, there is a correlation with the type of internet service (Appendix G). Areas with a high concentration of respondents with DSL and/or

satellite service had a high response rate of slightly to extremely dissatisfied with their internet service. In contrast, the City of Menomonie and around Lake Tainter had a response rate of slightly to extremely satisfied respondents, as is the case of those having internet cable service. Levels of satisfaction are due to a number of issues such as reliable connectivity, internet speed or bandwidth, or customer service.

Levels of satisfaction, type of service and to some extent, the access to the internet correlates with how much respondents are willing to pay for broadband level services. For example, respondents in the Town of Colfax are more willing to pay more for broadband connectivity and they had a fairly high dissatisfaction level a response rate. Additionally, they indicated fairly slow internet speeds (Appendix H). Respondents outside the City of Menomonie, particularly to the west, had similar response high dissatisfaction levels. In contrast, the City of Menomonie had more satisfied responses and faster connectivity, however, they were less receptive of similar broadband subscription cost.

Business Map Analysis

In general, the SRC Access to Broadband map for businesses (Appendix I) is similar to their Residential Access Broadband map in that there is a similar connectivity to the internet donut effect.

Again, similar to the residential responses, business satisfaction levels (Appendix J) is correlated with the internet speed (Appendix L), where slow speeds tend to have a higher rate of dissatisfied responses. High dissatisfaction levels also correlated with areas of high concentration of DSL and/or satellite service (Appendix K). Similarly to resident responses, the areas with high levels of satisfaction, slow internet service types, and slow internet speeds indicated that a majority of businesses are willing to pay more for broadband level services (Appendix N).

The analysis indicated that the size of the business (Appendix O) has a correlation with internet speeds. The map shows that businesses with 16 or more employees are more likely to operate where broadband or high speed internet access is available. For example, the Town of Colfax may not have broadband speed but does have sufficient internet connectivity to support small businesses operations. While the City of Menomonie has the highest concentration of businesses and larger operations due mainly to population and access to the interstate. It is still important to note that a majority of business respondents own their building (Appendix M) and majority are small businesses or employ only a handful of employees.

Overall, the similarities shown between the business and residential respondents in the maps indicate that a real gap in the need for broadband connectivity exist. Both businesses and residents with limited/no access or are highly dissatisfied with their level of internet service, value broadband connectivity more than in areas that are presently receiving broadband level services.

Future Directions for Dunn County

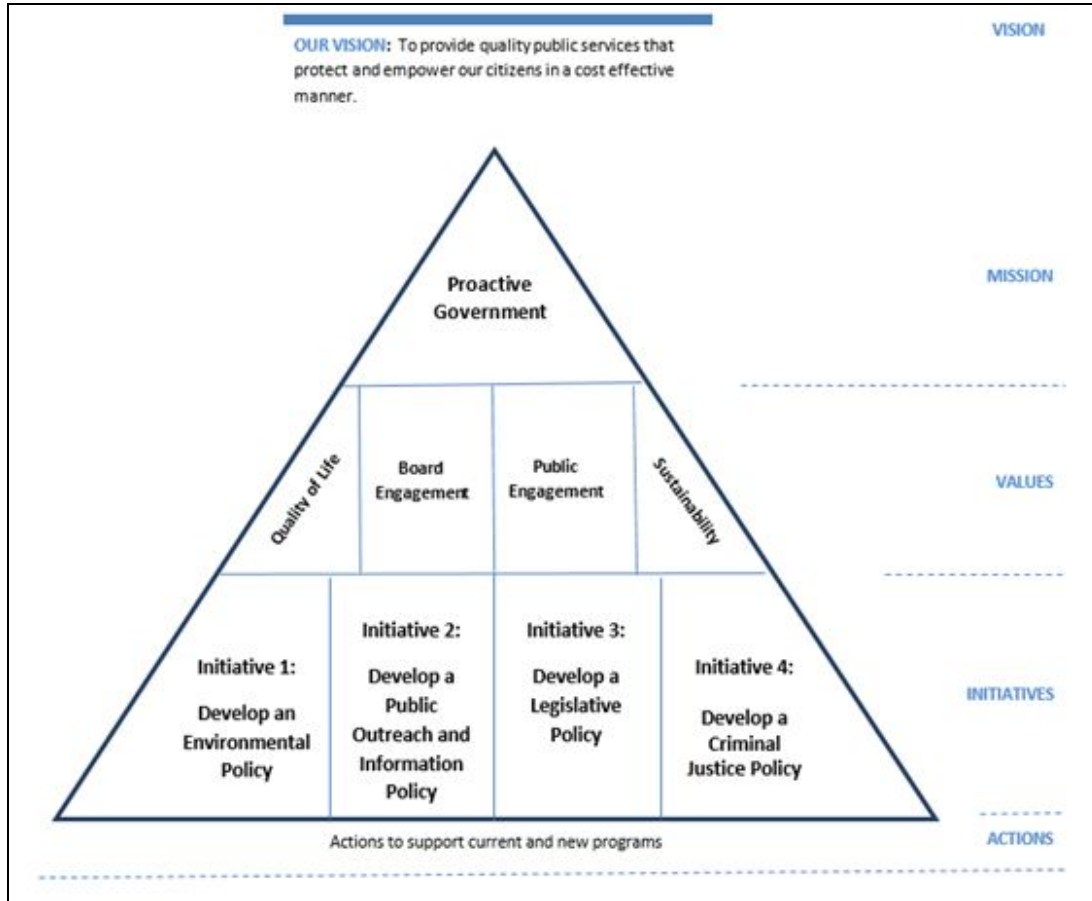
Dunn County's ultimate broadband goal is for everyone in the County to be connected. This goal will be met by working through an implementation process, containing a series of short and long term goals and objectives.

Goals are ideas of the future or desired results that a person or entity envisions, plans for and commits to achieve. They plan to reach these goals within a finite timeline by setting objectives. Objectives are specific results which a person or entity aims to achieve within a defined time frame and with available resources. In general, objectives are more specific than goals. Objectives are the basic tools that underlie planning and strategic activities and serve as the basis for creating policy and evaluating performance. While this plan establishes goals and objectives to meet the above broadband goal, it is important to note that "Broadband" is also a component of the County's Directional Plan.

The Directional Plan is a framework of Values and Initiatives (see Figure 8). The plan contains information on nearly 200 programs and services serving the needs of county residents and a list of ten (10) issues the County should pursue, of which broadband is one such issue. At its core is the plan's Mission, "*Proactive Government*" and its Vision, "*To provide public services that protect and empower our citizens in a cost effective manner.*" The plan promotes prioritizing the use of public assets through a collaborative planning process of continuous improvement, as the means to achieve its Mission and Vision. (To review the full Directional Plan document go to the Dunn County Website or use the following link: <http://bit.ly/2pMuqMw>)

Linking the implementation portion of this study with the methodology of the Directional Plan, should allow the County to position itself with its constituents, local Internet Service Provider's, the Public Service Commission and other agencies to leverage assets necessary to extend broadband into the rural areas of Dunn County.

Figure 8. The Dunn County Directional Plan Pyramid/Framework



(Source: Dunn County)

Broadband Goals

Building the most robust, high capacity and functionally diverse fiber network possible will ensure Dunn County’s broadband infrastructure is future proof. While fiber to all homes may not be an achievable goal for the entire County, it may be a possibility in more densely populated areas and for those individuals along fiber lines. For remote and rural locations, wireless and new technologies are being developed and should continuously be considered. As the state’s interest in rural broadband increases and resources allocated to support broadband expansion, service providers will have more incentives than any other time to expand their service areas. The reduction in the financial burdens on service providers should influence and encourage the development of a robust broadband network. County-wide broadband access will allow Dunn County to stay true to its commitment to be an engaging, supportive, and proactive environment for all stakeholders. This report shows the County’s commitment towards achieving these statements, with end goals of:

1. **Provide countywide broadband access with speeds in excess of 25Mbps/3Mbps.** Emphasizing a higher quality of life for residents and supportive economic environment.
2. **Provide One to One access for all Pre-K to 12 students.** With a longer term goal of One to One to all individuals throughout the county.

Meeting those goals will position Dunn County to provide a quality of life and the amenities expected of the county by its residents, businesses, and stakeholders.

Short Term Objectives

The following objectives should be in place within the first year from the start of implementation. It is important to note that short term objectives may extend many years into the future and it is entirely possible that short and long term objectives could overlap.

Get the Word Out

1. **Organize conversations with individual service providers to understand the County's role in their broadband expansion efforts .**
2. **Organize conversations with the PSC to understand the roles of; the County, service providers, local jurisdictions, businesses and the public at large in their grant process.**
3. **Organize "Community Conversations".**
 - a. Invite residents, businesses, local jurisdictions, regional representatives and service providers to discuss the above roles and relationships related to this study/report.

Long Term Objectives

The following objectives should be in place within the two years from the start of implementation. Once they are established they could continue well into the future or until the implementation plan is amended/updated and it is entirely possible that short and long term objectives could overlap.

1. **Advocate for broadband expansion** to position the county to successfully move forward.
 - a. Bring proposed broadband legislation to appropriate standing Committees as part of the County's Legislative initiative.
 - b. Research and present findings/recommendations regarding "Broadband Forward Certification" to appropriate standing Committees.
2. **Develop a meeting schedule for the Team** (Dunn County Planning, UW-Extension,

and DCEDC) to;

- a. Investigate and share findings related to emerging broadband technology.
 - b. Share findings related to emerging broadband related legislation.
 - c. Discuss the grant process and other funding mechanisms.
 - d. Provide status reports on existing and proposed grants.
 - e. Create and present Broadband reports to appropriate standing committees.
3. **Establish and maintain relationships with service providers**
- a. Understand the industry, its challenges, and how the county can effectively support their efforts to expand broadband access.
 - b. Collaborate on methods to connect key stakeholders such as school districts, public libraries, government units, etc. with service providers and other supporting entities to discuss roles and responsibilities related to broadband grants and/or other funding mechanisms.
4. **Organize quarterly “Broadband” community discussions**
- a. Continuously inform residents, businesses, and stakeholders of the status of existing and upcoming grants and distribute other broadband information.
 - b. Conduct focused meetings on how to support and expand broadband such as: writing effective letters of support, expansion strategies, etc.
 - c. Raise awareness and educate residents and businesses about the importance of broadband, referencing the study, survey, and maps.
5. **Maintain membership in Region 3 Broadband Implementation Group.**

Moving Forward

The County has expressed a desire to support its resident and business communities by positioning them in preparation for an internet connected society. The internet has the potential to increase the human capacity and potential especially to those in remote areas who would not otherwise have the same opportunities as those in urbanized areas. The broadband gap analysis is the initial step to understand where gaps exist in the county. The outcome of this study provides valuable information and insight to help the county prepare its residents and businesses for a future that includes broadband accessibility.

Appendix

Appendix A. Dunn County Economic Profile

Dunn County *ECONOMIC PROFILE*

County Population Projections

	2010	2015	2020	2015	2030	2035	2040
County Population	43,857	45,500	46,440	47,415	47,970	48,200	48,485
Percent Change		3.9	2.1	2.1	1.2	0.5	0.6
Male	22,133	23,065	23,540	24,015	24,235	24,155	24,245
Female	21,724	22,435	22,900	23,400	23,735	24,045	24,240
Minority	2,312	NA	NA	NA	NA	NA	NA
Percent Minority	5.3	NA	NA	NA	NA	NA	NA
Age Under 5	2,422	2,370	2,370	2,390	2,410	2,450	2,480
Age 5-9	2,497	2,530	2,430	2,440	2,470	2,480	2,510
Age 10-14	2,566	2,780	2,810	2,700	2,690	2,690	2,680
Age 15-19	4,186	3,940	4,080	4,060	3,870	3,790	3,680
Age 20-24	5,997	5,900	5,790	5,970	5,940	5,550	5,370
Age 25-34	4,983	4,880	4,890	4,880	4,900	4,960	4,810
Age 35-44	4,947	4,880	4,630	4,450	4,440	4,430	4,450
Age 45-54	5,897	5,650	5,180	5,060	4,820	4,620	4,630
Age 55-59	2,699	3,100	3,080	2,670	2,640	2,590	2,480
Age 60-64	2,340	2,750	3,050	3,050	2,650	2,660	2,660
Age 65-74	2,754	4,010	4,900	5,530	5,860	5,590	5,430
Age 75-84	1,721	1,820	2,315	3,220	3,990	4,590	5,020
Age 85+	848	890	915	995	1,290	1,800	2,285



PREPARED BY THE
WEST CENTRAL WISCONSIN
REGIONAL PLANNING COMMISSION

January, 2017

Source: 2010 Census; Wisconsin DOA Population Projections, December 2013

Municipal Population

	1980	1990	2000	2010	2016	Percent Change			
						1980-90	1990-00	2000-10	2010-16
Menomonie	12,769	13,547	14,937	16,264	16,338	6.1	10.3	8.9	0.5
Colfax	1,149	1,110	1,136	1,158	1,123	-3.4	2.3	1.9	-3.0
Boyceville	862	913	1,043	1,086	1,089	5.9	14.2	4.1	0.3
Elk Mound	737	765	785	878	872	3.8	2.6	11.8	-0.7
Knapp	419	419	421	463	462	0.0	.5	10.0	-0.2
Wheeler	231	348	317	348	346	50.6	-8.9	9.8	-0.6
Ridgeland	300	246	265	273	273	-18.0	7.7	3.0	0.0
Downing	242	250	257	265	263	3.3	2.8	3.1	-0.8

Source: 1980, 1990, 2000 and 2010 Census and Wisconsin DOA 2016 Estimates

Per Capita Personal Income

	2012	2013	2014	2015	Percent Change		
					2012-13	2013-14	2014-15
Dunn County	\$35,574	\$35,575	\$36,541	\$36,316	0.003	2.7	-0.6
Wisconsin	\$42,536	\$42,722	\$44,406	\$45,914	0.4	3.9	3.4
United States	\$44,267	\$44,462	\$46,414	\$48,112	0.4	4.4	3.7

Total personal income includes income from three sources: net earnings; dividends, interest and rent; and transfer receipts. Total personal income divided by the total population produces per capita personal income (PCPI).

Source: US Dept. of Commerce, Bureau of Economic Analysis

Consumer Expenditures by County (total \$000's)

	Total		Total
Shelter	\$178,500	Education	\$29,227
Transportation	\$167,613	Household Operations	\$23,464
Food and Beverages	\$129,369	Gifts	\$20,350
Health Care	\$71,709	Miscellaneous Expenses	\$12,973
Utilities	\$66,962	Personal Care	\$11,294
Entertainment	\$48,326	Personal Insurance	\$6,095
Contributions	\$34,930	Tobacco	\$5,708
Apparel	\$30,027	Reading	\$1,920
Household Furnishings	\$29,262		

Source: Applied Geographic Solutions, 2016

Government Finances

2015	County	State
Full Equalized County Valuation (\$000)	\$2,802,597	\$490,602,544
Net Property Tax (\$000)	\$60,222	\$9,767,155
Full Value Tax Rate per \$1,000 Valuation	\$21.49	\$19.91
Per Capita Property Tax	\$1,359.56	\$1,697.65

Source: Town, Village and City Taxes, Wisconsin Dept. of Revenue

Civilian Labor Force

County Totals	2011	2015
Employed	21,662	22,612
Unemployed	1,711	1,081
Total Labor Force	23,373	23,693
Average County Unemployment Rate	7.3%	4.6%
Average State Unemployment Rate	7.8%	4.6%
Average U.S. Unemployment Rate	8.9%	5.3%

Source: Wisconsin Department of Workforce Development

Housing

	County
Housing Units	18,082
2016 Estimated Housing Units	18,522
Owner Occupied Units	11,111
Renter Occupied Units	5,330
Persons/Owner Occupied Unit	2.5
Persons/Renter Occupied Unit	2.3
Median Value of Housing	\$153,700
Median Monthly Gross Rent	\$721

Source: 2011-2015 American Community Survey 5-Year Estimates and DOA Housing Estimates for 2016

Representative Wage Rates

Position	2015 Hourly Rate	
	Mean	Median
Bartenders	\$8.83	\$8.73
Bookkeeping/Accounting/Auditing	\$16.47	\$16.09
Cashiers	\$9.09	\$8.87
Computer Programmers	\$32.10	\$30.10
Electricians	\$26.71	\$26.75
Healthcare Social Workers	\$23.16	\$22.73
Licensed Practical/Vocational Nurse	\$19.20	\$18.97
Machinery Maintenance Workers	\$21.06	\$20.43
Nursing Assistants	\$13.07	\$13.04
Office Clerk, General	\$14.51	\$14.29
Physical Therapists	\$35.99	\$36.25
Secretaries/Administrative Assistants	\$21.76	\$21.25
Stock Clerk/Order Fillers	\$11.70	\$10.21
Truck Drivers-Heavy/Tractor Trailer	\$20.05	\$18.46
Waiter and Waitresses	\$8.58	\$8.57
Welder/Cutter/Solderer/Brazer	\$18.46	\$18.24

Source: Bureau of Labor Statistics, May 2015

Building Permits

County Residential	2010	2015
Single Family	59	173
Total Units	67	180
Value	\$10,024,334	\$19,830,538

Source: Bureau of the Census

Employment by Industry

	2011-2015 5-Year Estimate	% of Total Employment
Agriculture/Forestry/Fishing/Hunting/Mining	1,153	5.1
Construction	1,296	5.8
Manufacturing	3,661	16.3
Wholesale Trade	641	2.8
Retail Trade	2,973	13.2
Transportation and Warehousing, and Utilities	1,075	4.8
Information	162	0.7
Finance and Insurance/Real Estate/Rental and Leasing	997	4.4
Services (Professional/Educational/Entertainment/Other)	9,954	44.3
Public Administration	582	2.6
TOTAL*	22,270	100.0

+ Represents the total number of jobs provided by employers within the County and not the total number of employed individuals in the County.
 Source: American Community Survey, 2011-2015 5-Year Estimates

Industry Employment Projections (West Central WI)

	Estimated Employment*		% Change
	2012	2022	
Total, All Nonfarm Industries	179,507	197,498	10.0
Mining/Natural Resources	2,217	2,082	-6.1
Manufacturing	31,604	31,062	-1.7
Construction	6,251	7,672	22.7
Trade, Transportation and Utilities	36,849	39,788	8.0
Information	1,730	1,697	-1.9
Financial Activities (finance/insurance/real estate/rental and leasing)	7,060	7,668	8.6
Professional and Business Services (professional/management/remediation)	15,691	19,602	24.9
Educational and Health Services (including State/Local Government)	33,232	39,322	18.3
Leisure and Hospitality	18,240	20,248	11.0
Other Services (except Government)	4,779	5,031	10.9
Government	12,122	12,750	5.2
Self-Employed and Unpaid Family Workers (all jobs)	9,732	10,306	5.9

*Employment is a count of jobs rather than people, and includes all part- and full-time nonfarm jobs.
 Source: Office of Economic Advisors, Wisconsin Dept. of Workforce Development, September 2015

Largest Employers

Employer	Industry Type	Employees
3M	Coated and laminated paper manufacturing	1,000+
WalMart Distribution Center	All other durable goods merchant wholesalers	1,000+
Mayo Clinic Health System-Red Cedar	General medical and surgical hospitals	1,000+
ConAgra Foods, Inc.	Frozen specialty & all other miscellaneous food manufacturing	1,000+
Andersen Menomorie, Inc.	Other building material dealers	250-499
CEVA Logistics	Freight transportation arrangement	250-499
Cardinal Glass Industries, Inc.	Flat glass manufacturing	100-249
Colfax School District	Elementary and secondary schools	100-249
Dunn County Health Care Center	Nursing care facilities (skilled nursing)	100-249
Colfax High School	Elementary and secondary schools	100-249
Lakeland Cooperative	Other similar organizations promoting members' interests	100-249
Neighbors of Dunn County	Nursing care facilities (skilled nursing)	100-249
Marketplace Foods Menomorie, Inc.	Supermarkets and other grocery stores	100-249
Menomorie High School	Elementary and secondary schools	100-249
Menomorie Middle School	Elementary and secondary schools	100-249
Phillips-Medisize	Surgical and medical instrument manufacturing	100-249
University of Wisconsin-Stout	Colleges and universities	100-249
UW-Stout University Dining Services	Caterers	100-249
WalMart Supercenter	Department stores (except discount department stores)	100-249
Westconsin Credit Union	Credit unions	100-249
Tiffany Creek High School	Elementary and secondary schools	50-99
Midwest Stainless Tech	Food product machinery manufacturing	50-99
Colfax Health & Rehabilitation Center	Continuing care retirement communities	50-99

Source: Wisconsin DWD; Major employers were extracted from the America's Labor Market Information System Employer Database

Appendix B. Public Service Commission Broadband Expansion Grant Letter



Public Service Commission of Wisconsin

Ellen Nowak, Chairperson
 Mike Huebsch, Commissioner
 Lon Roberts, Commissioner

610 North Whitney Way
 P.O. Box 7854
 Madison, WI 53707-7854

October 11, 2017

From: Wisconsin State Broadband Office
 To: Persons Interested in the Broadband Expansion Grant Program
 Re: FY 2018 Broadband Expansion Grants 5-BF-2018

Announcement of the Commencement of the Grant Cycle for
 Fiscal Year 2018, Round2

The Public Service Commission is pleased to announce that it is now accepting applications for the second round of Fiscal Year (FY) 2018 Broadband Expansion Grants. This second round will make available \$7.5 million of the additional funds recently appropriated in the state budget for the FY 2018-2019 biennium. There are a few changes in the grant application instructions for the FY 2018 Round 2 grant cycle, and we wish to highlight those changes in this announcement letter.

1. Schedule of Events

The schedule of events related to this year’s grant application is as follows:

DATE	EVENT
October 11, 2017	Date of issue of the application instructions
January 11, 2018	Last day for submitting questions and requests for clarification
January 25, 2018	Applications due from applicants
Jan 26 – Feb 15, 2018	Public comment period
February 15, 2018	Last day for submitting comments regarding filed grant applications

2. We are also announcing the tentative dates for the FY 2019 grant round, to allow communities and providers additional time to prepare project applications. This round of grants will extend another \$7.0 million to underserved areas of the state. Applications

Telephone: (608) 266-5481
 Home Page: <http://psc.wi.gov>

Fax: (608) 266-3957
 E-mail: pscsecs@wisconsin.gov

Docket 5-BF-2018

Page 2

will tentatively be due in June 2018, and the Commission will likely issue those awards in August or September of 2018.

3. The 2017-19 budget provides for a sustained level of funding for the broadband grant program, at \$2 million per year, beginning in FY 2019. Beginning in FY 2020, the Commission expects to conduct a single broadband grant proceeding each year, with less variation in the schedule for the proceeding. Tentatively, grant applications will be due in June of each year, and the Commission's open meeting decision will occur in the late summer or early fall of each year.
4. The 2017-19 budget made some changes to the factors the Commission uses to score the application.
 - a. The most important change concerns the priority consideration given to projects that propose to serve an area that is currently unserved.
 - In the past, applicants received priority credit for serving an area that did not have any broadband provider offering service at a speed of 25 Mbps down / 3 Mbps up. With the 2017-19 budget, an unserved area now means an area with no broadband provider offering a service of least 5 Mbps down / 600 Kbps up.
 - b. The budget act added a seventh priority factor to assess the affect a grant proposal could have upon the provision of broadband service in adjacent areas.
 - To some degree, this new statutory language merely codifies the Commission's existing approach. In each grant cycle, the Commission has looked carefully at the concerns of competing providers concerning the effect of overlapping broadband services in and near the proposed project area. This new language strengthens the Commission's ability to consider whether proposed broadband construction would impact alternatives in the area.
5. Applications must be filed using the PSC Electronic Regulatory Filing (ERF) system. You must be a registered user to access this site, and we encourage applicants to complete their registration well in advance of the application due date. Instructions for registering are available on the ERF system website at https://apps.psc.wi.gov/vs2015/ERF_upload/subscribe/subscribeHome.aspx.
6. We have again tweaked the first page of the application instructions. Thank you to those that offered suggestions after the last grant round.
 - We request each applicant download the editable Word version of the application instructions, fill in the information requested for each blank box, and include this page as the first page of the grant application. Our hope is to create a one-page 'snapshot' of the grant application.

Docket 5-BF-2018

Page 3

7. The application instructions for this grant cycle again request a reference to an on-line map file, if available.
 - The Broadband Office staff will use the map information provided by applicants to create a briefing tool for the Commission when it decides which grant applications to fund. Specifically, staff will use ARCGIS software to create a layer illustrating the location of the proposed grant project areas together with additional layers showing the unserved and underserved areas in the state, the availability of CAF II funding, and other details that may be relevant in reviewing the grant applications.
 - No application will be given less consideration based upon the lack of a compatible electronic map file. Staff will use the available map detail provided by applicants, regardless of format, to develop a summary that is consistent from one application to the next. It is conceivable that in future grant cycles the Commission will require a specific compatible format for map information.
8. The Commission will provide a public comment period so that interested persons may review the grant applications that have been submitted and file written comments concerning the relative merits of the applications under review.
 - The public comment period for this grant cycle is January 26 to February 15, 2018.
 - The Commission will only accept public comments. Criticism of applications explicitly or implicitly based upon confidential and other non-public service data will not be given weight in the evaluation process.
9. The application period extends through the winter holiday period. We will have staff available to respond to inquiries during the holidays.

Questions regarding the grant application process and program administration may be addressed to Dennis Klaila at (608) 267-9780, or at dennis.klaila@wisconsin.gov. Questions and concerns about the content of the application or the meaning of any provision of the application instructions should be addressed to the state broadband office, as provided in the Instructions at sec. 1.5. If we find that the Instructions are unclear or in error, we will provide a clarification to the mailing list for this docket.

Sincerely,

Angie Dickison, Director
State Broadband Office

AD:DK::DL:01585498

Appendix C. Resolution 58

REPORT & RESOLUTION NO. 58

Supervisor Storj moved for adoption of Resolution No. 58 supporting improved broadband service availability access and utilization in Dunn County, seconded by Supervisor Solberg. Chairman Rasmussen noted this resolution falls in line with the Dunn County Directional Plan. Supervisor Solberg spoke to the resolution. Motion carried by voice vote.

**RESOLUTION NO. 58
SUPPORTING IMPROVED BROADBAND SERVICE AVAILABILITY,
ACCESS AND UTILIZATION IN DUNN COUNTY**

BE IT RESOLVED, the Dunn County Board of Supervisors is committed to strengthening and maintaining broadband infrastructure throughout Dunn County at a level that allows for education, business and industry to compete on a global level based on data capacity, speed and adoption by the Dunn County, WI citizens; now and in the future.

BE IT FURTHER RESOLVED, the Dunn County Board of Supervisors designates the Community Resources and Tourism Committee as the body responsible for developing and recommending policy to the Board of Supervisors related to broadband infrastructure.

Offered this 15th day of June, 2016, at Menomonie, Wisconsin.

OFFERED BY:

COMMUNITY RESOURCES AND TOURISM
COMMITTEE:
Sheila Storj, Chair

ENACTED ON: June 15, 2016

ATTEST:
Julie A. Wathke, County Clerk

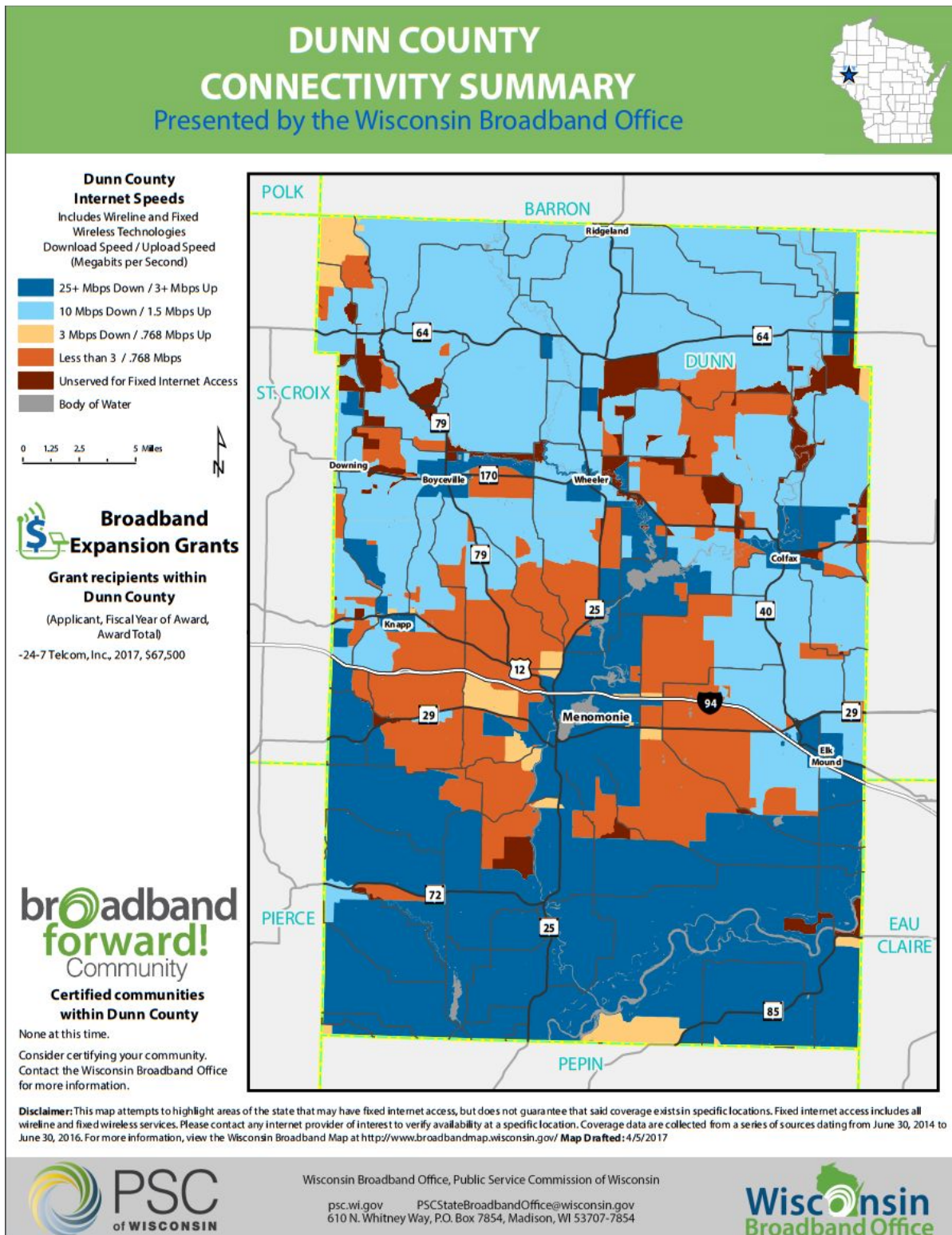
Approved as to Form and Execution:
Nicholas P. Lange, Corporation Counsel

Budget Impact: This resolution has no impact upon the budget or levy for 2016 or 2017.

Background Information: Improved access to advanced broadband services is paramount to the health and wellbeing of Dunn County citizens, business, industry and agriculture in the areas of communication, public safety, educational excellence, economic development and growth, tourism, emergency management, entertainment, medical services and usages being and yet to be developed. However, large portions of Dunn County are underserved as to the availability and access to adequate broadband service.

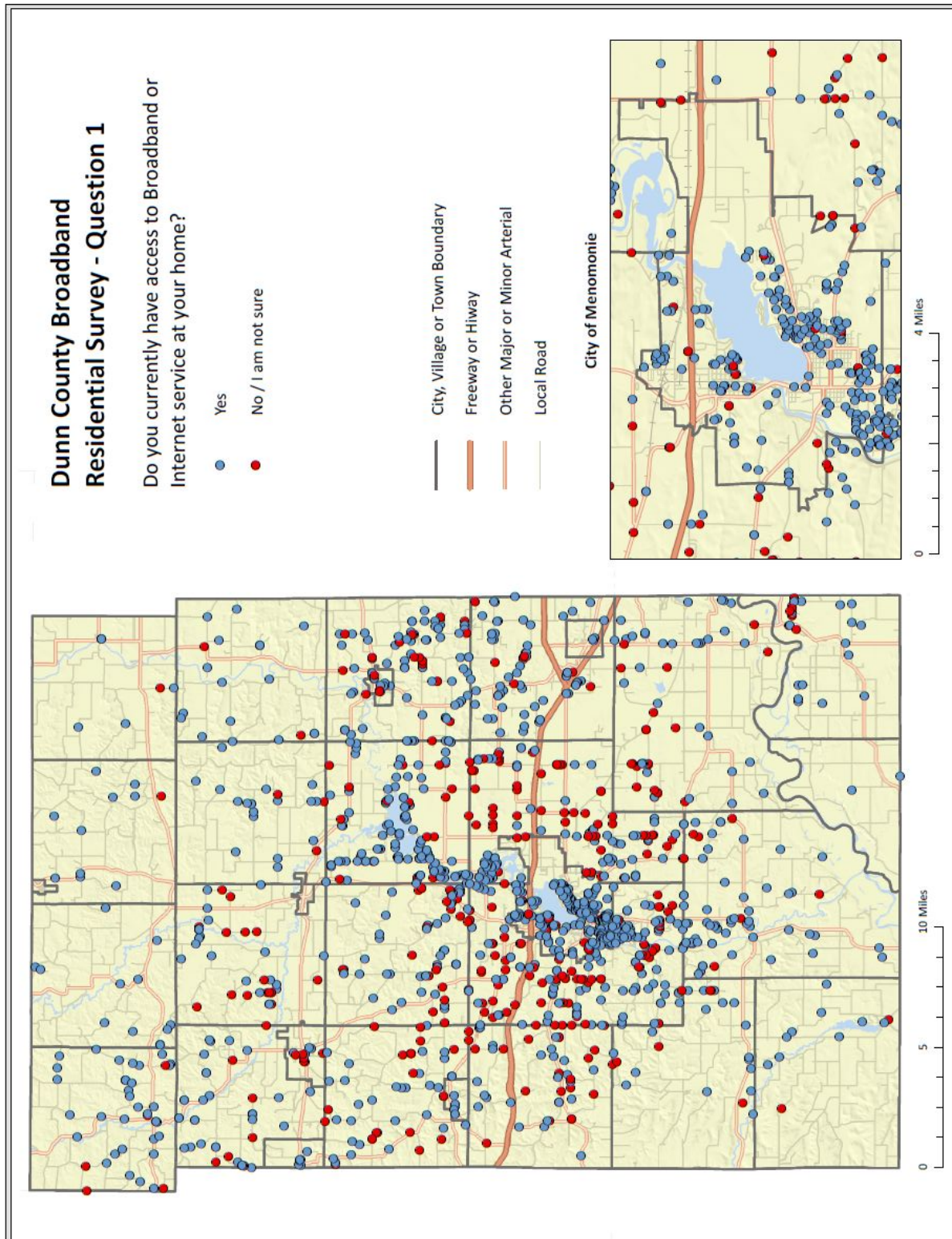
Cooperative efforts between county, city and township government entities with the broadband providers that serve the County is necessary for success. To that end, the Dunn County Board of Supervisors desires to establish a role as a driver of the initiative to increase the availability, delivery, and utilization of broadband services throughout the county.

Appendix D. PSC Broadband Connectivity Map - Dunn County

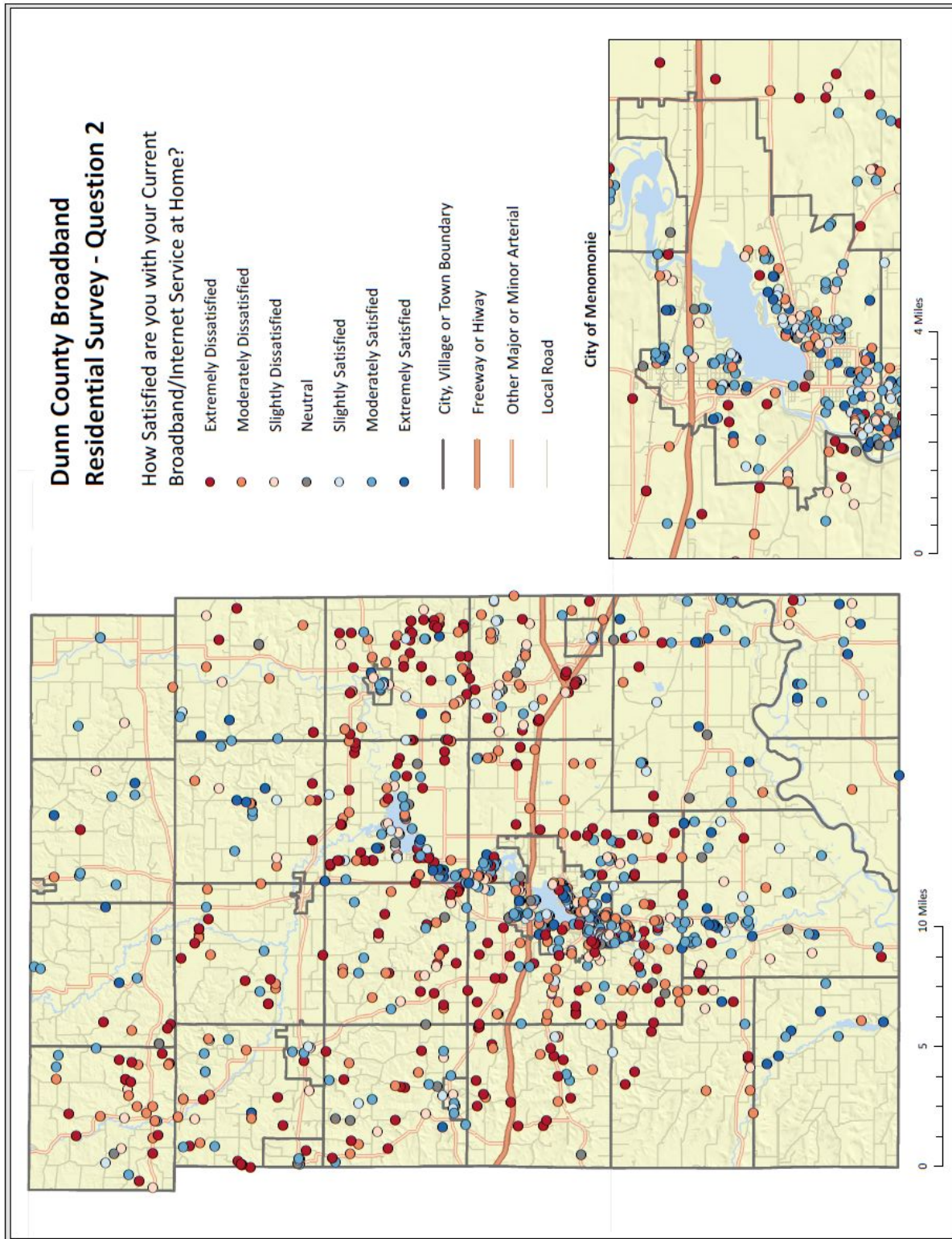


(Source: Public Service Commission)

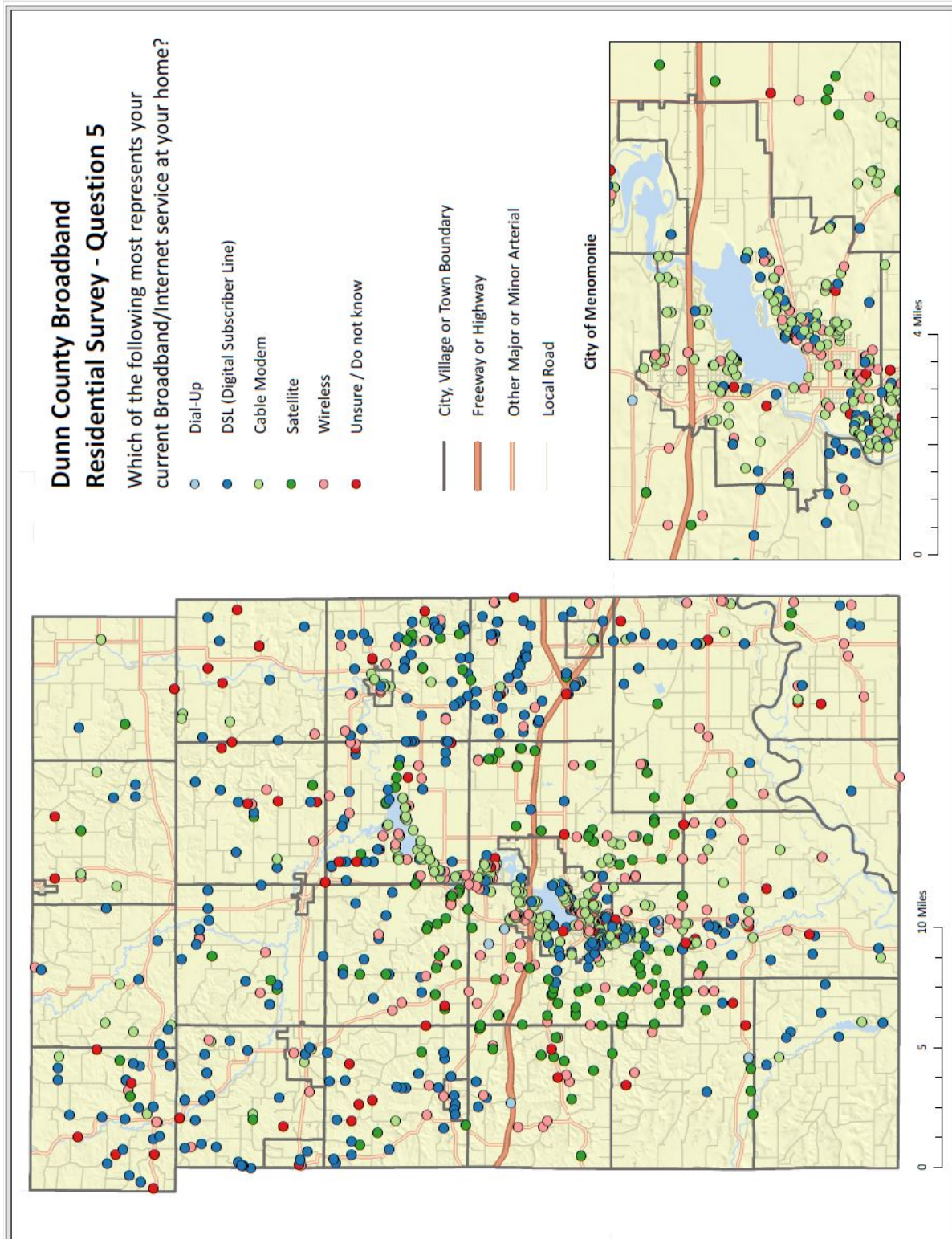
Appendix E. SRC Map Residential Question 1: Do you currently have access to Broadband or Internet service at your home?



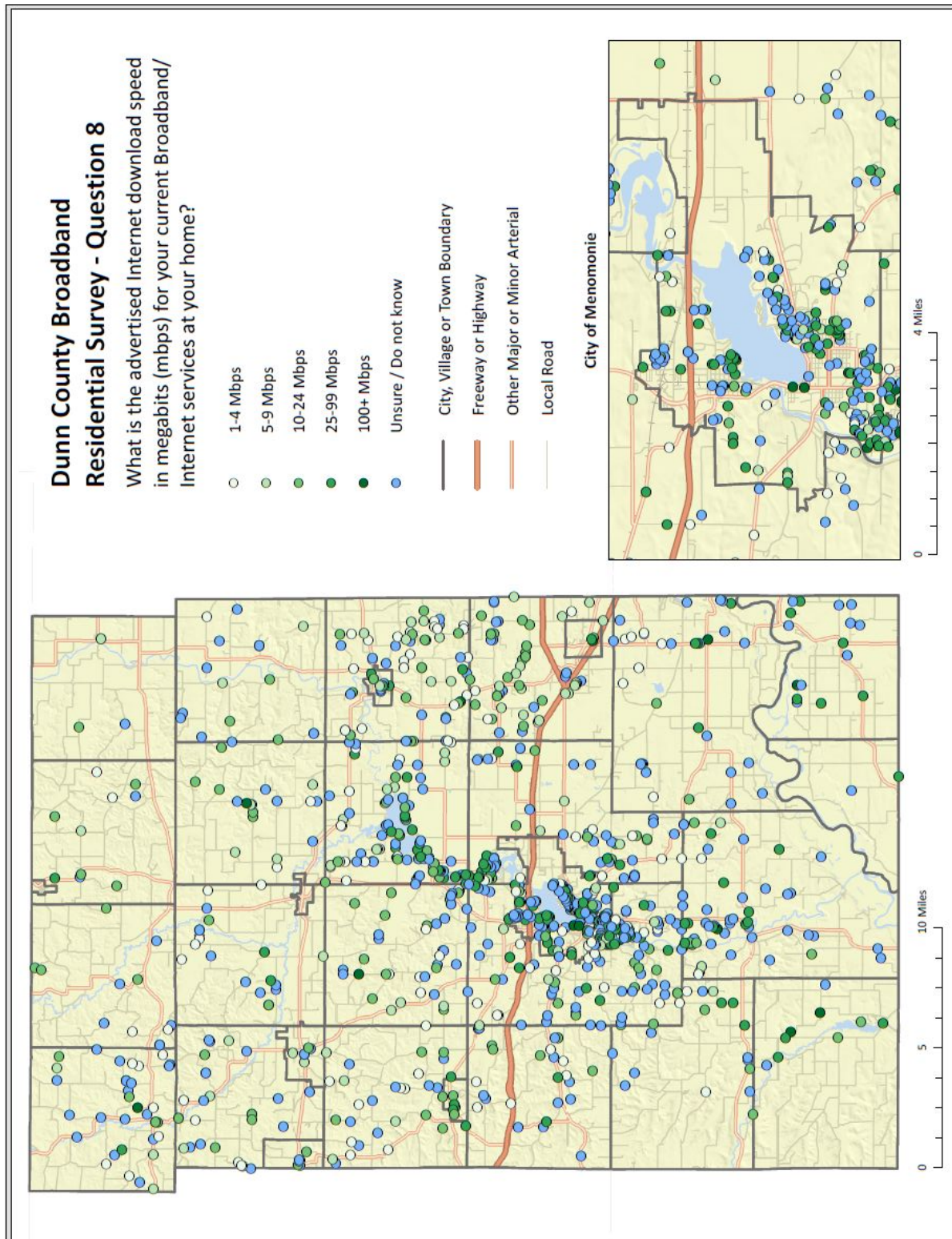
Appendix F. SRC Map Residential Question 2: How Satisfied are you with your Current Broadband/Internet Service at Home?



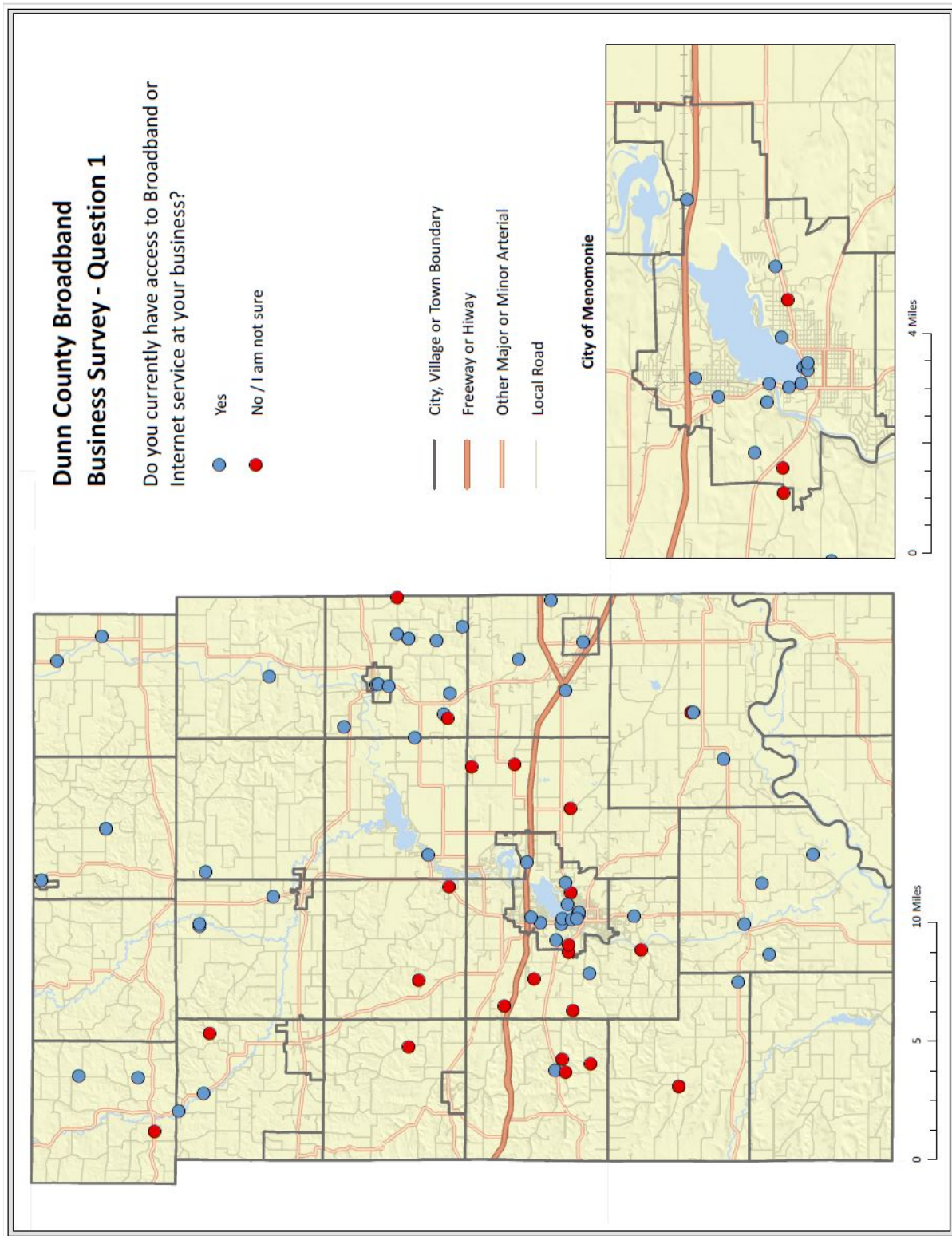
Appendix G. SRC Map Residential Question 5: Which of the following most represents your current Broadband/Internet service at your home?



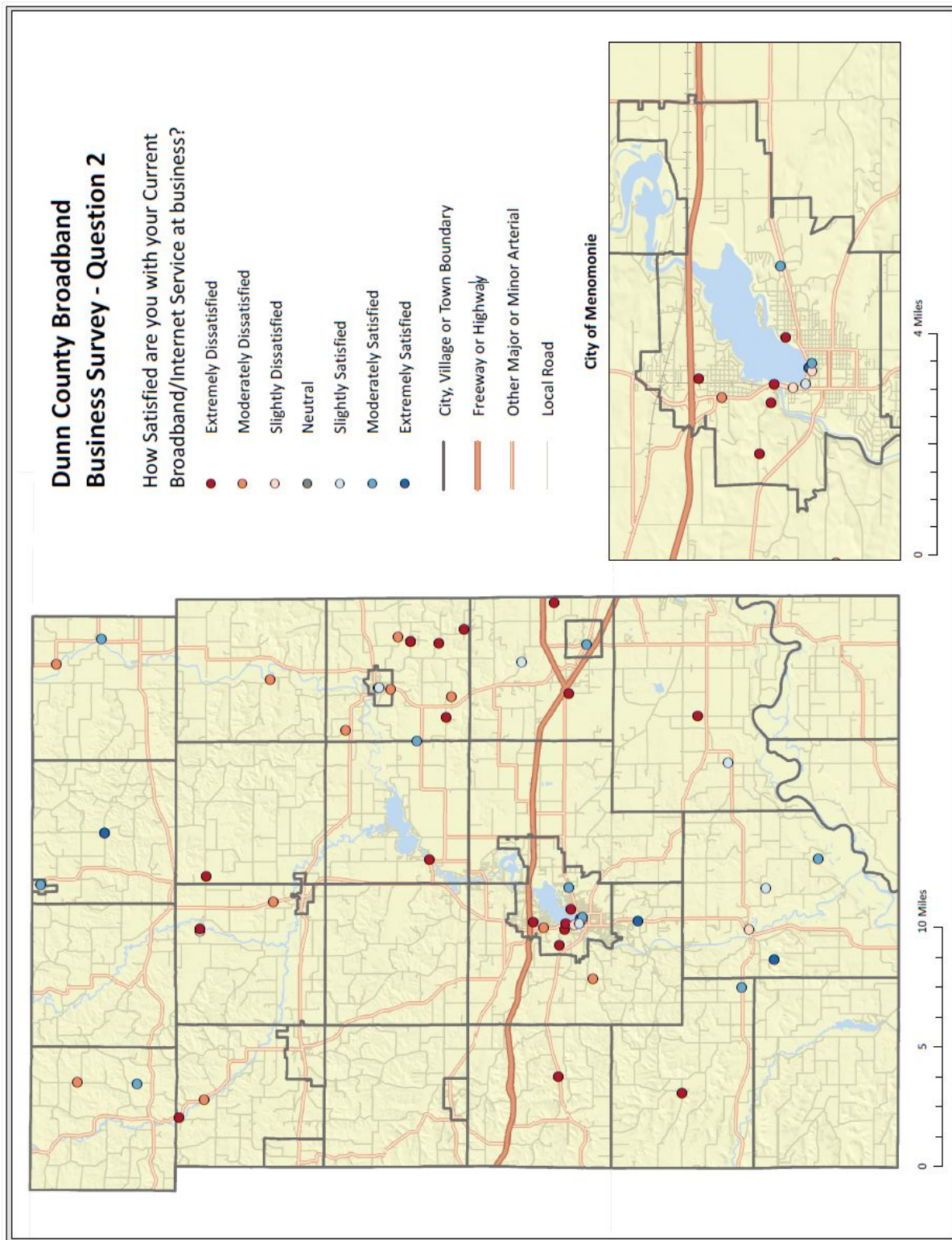
Appendix H. SRC Map Residential Question 8: What is the advertised Internet download speed in megabits (mbps) for your current Broadband/Internet services at your home?



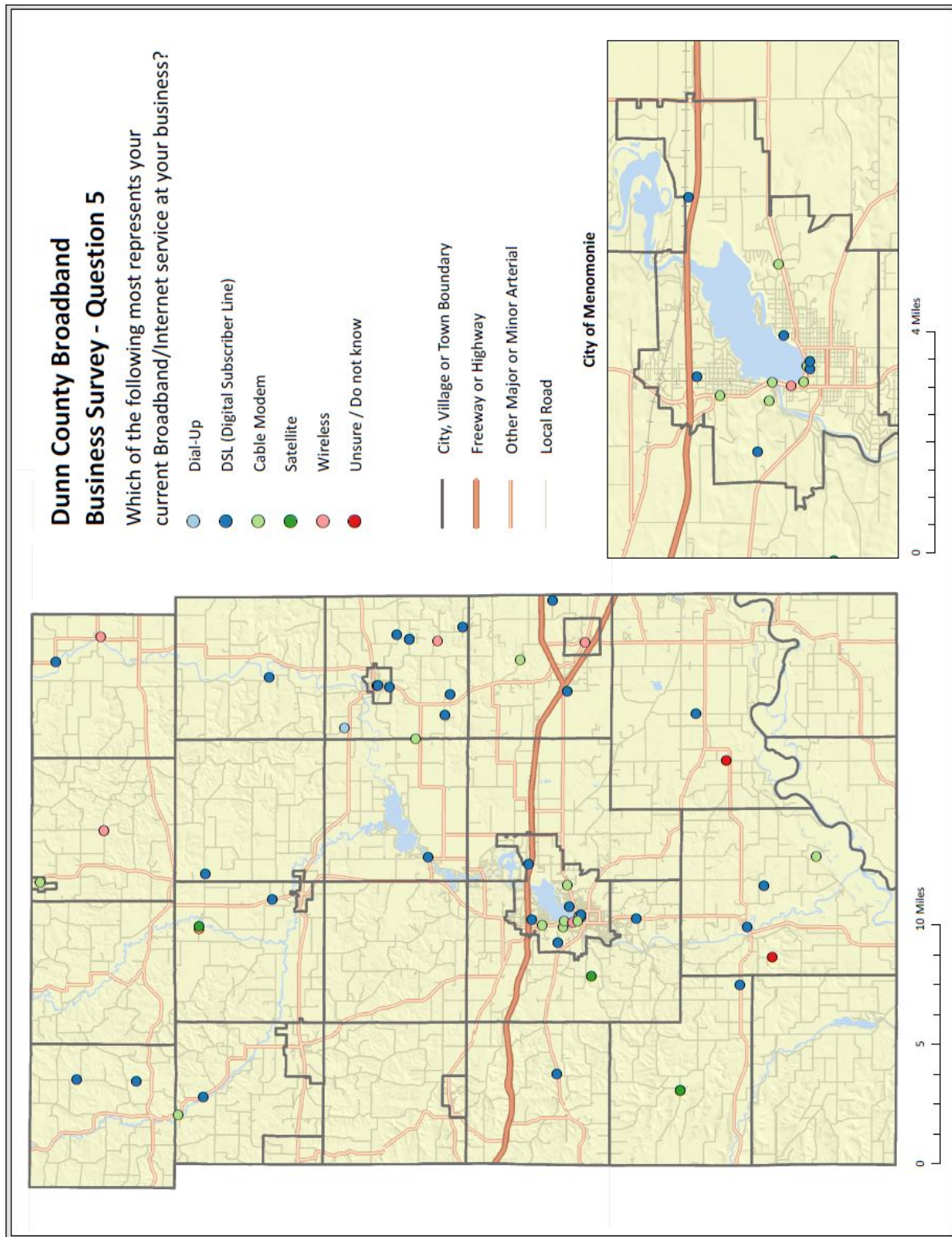
Appendix I. SRC Map Business Question 1: Do you currently have access to Broadband or Internet service at your business?



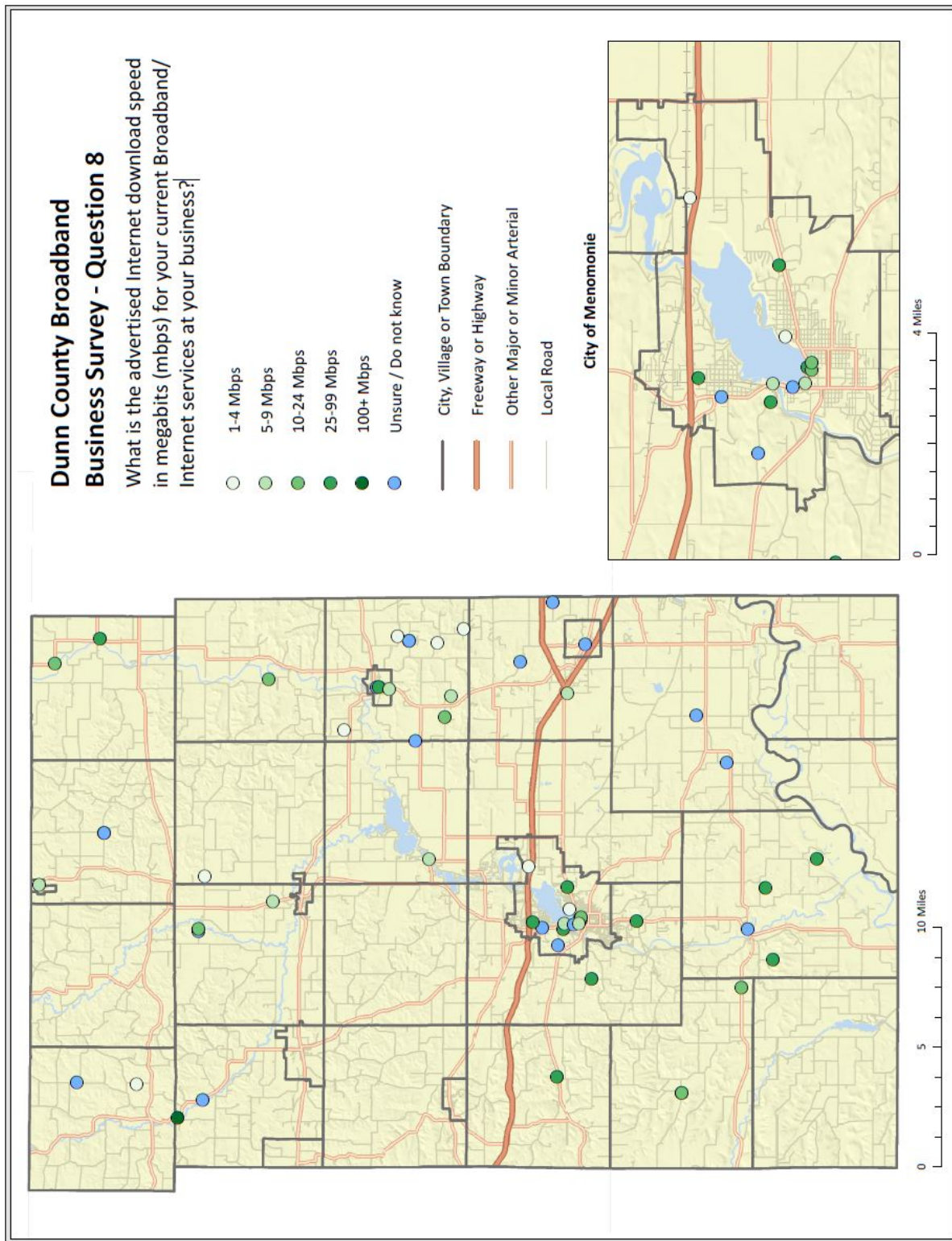
Appendix J. SRC Map Business Question 2: How Satisfied are you with your Current Broadband/Internet Service at business?



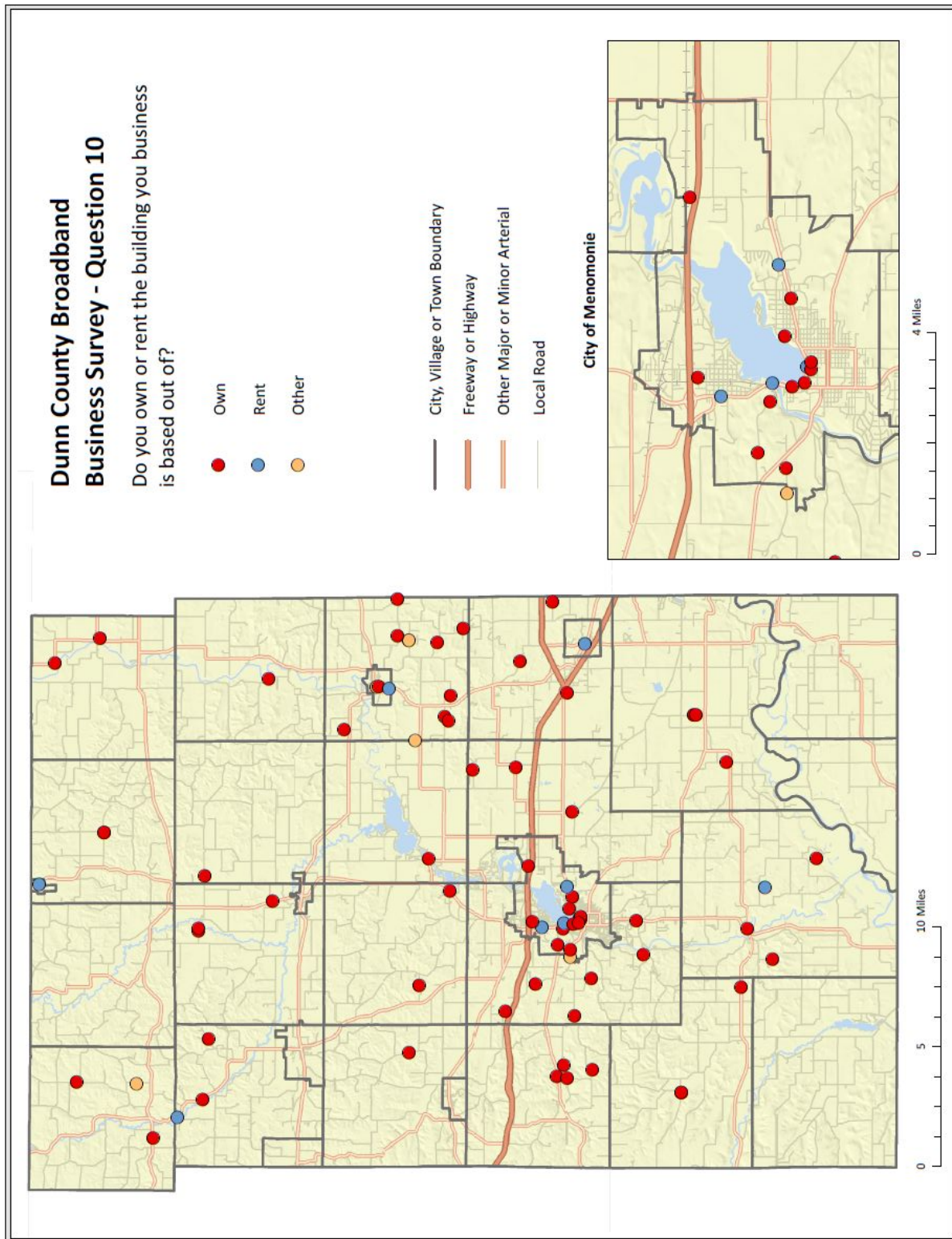
Appendix K. SRC Map Business Question 5: Which of the following most represents your current Broadband/Internet service at your business?



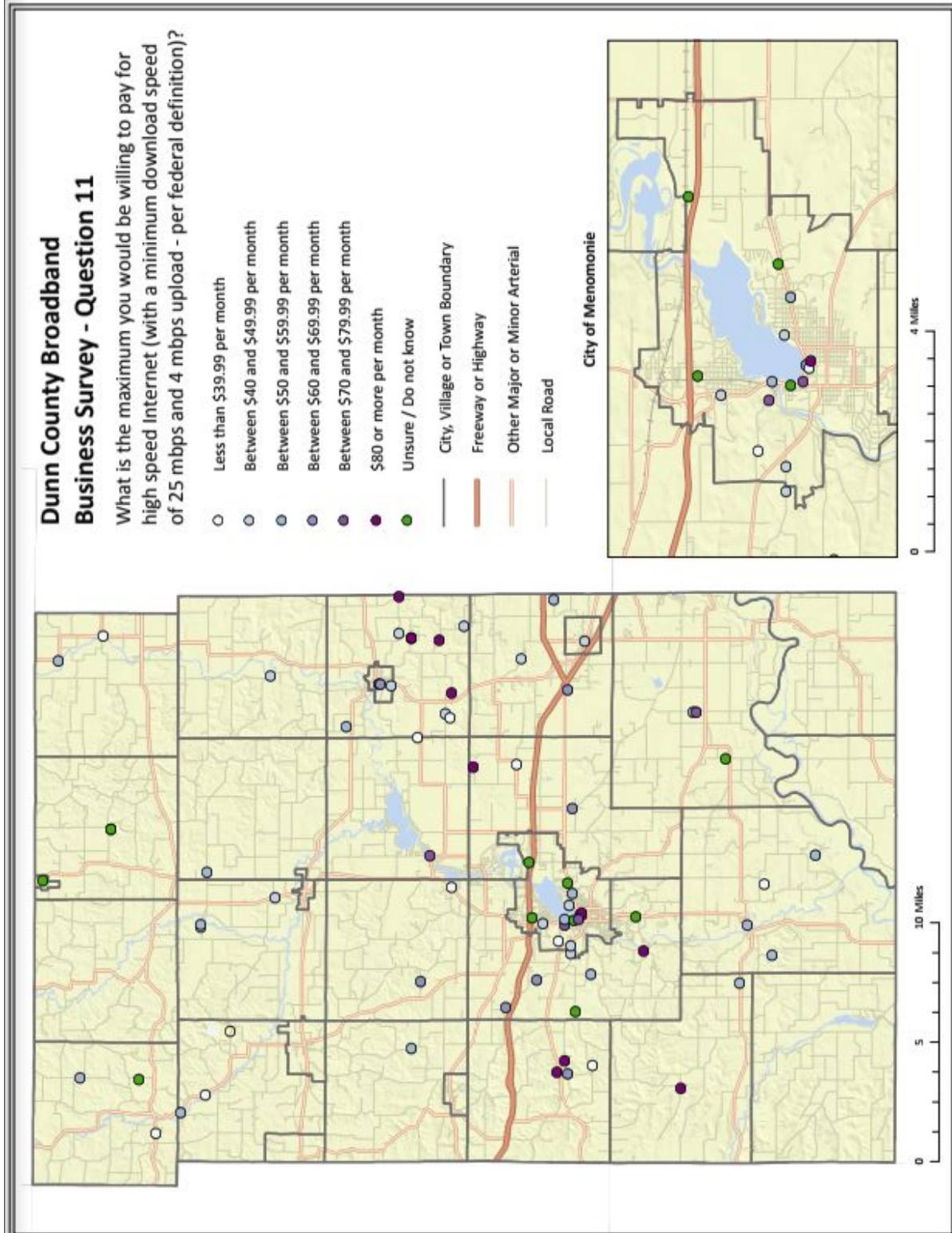
Appendix L. SRC Map Business Question 8: What is the advertised Internet download speed in megabits (mbps) for your current Broadband/Internet services at your business?



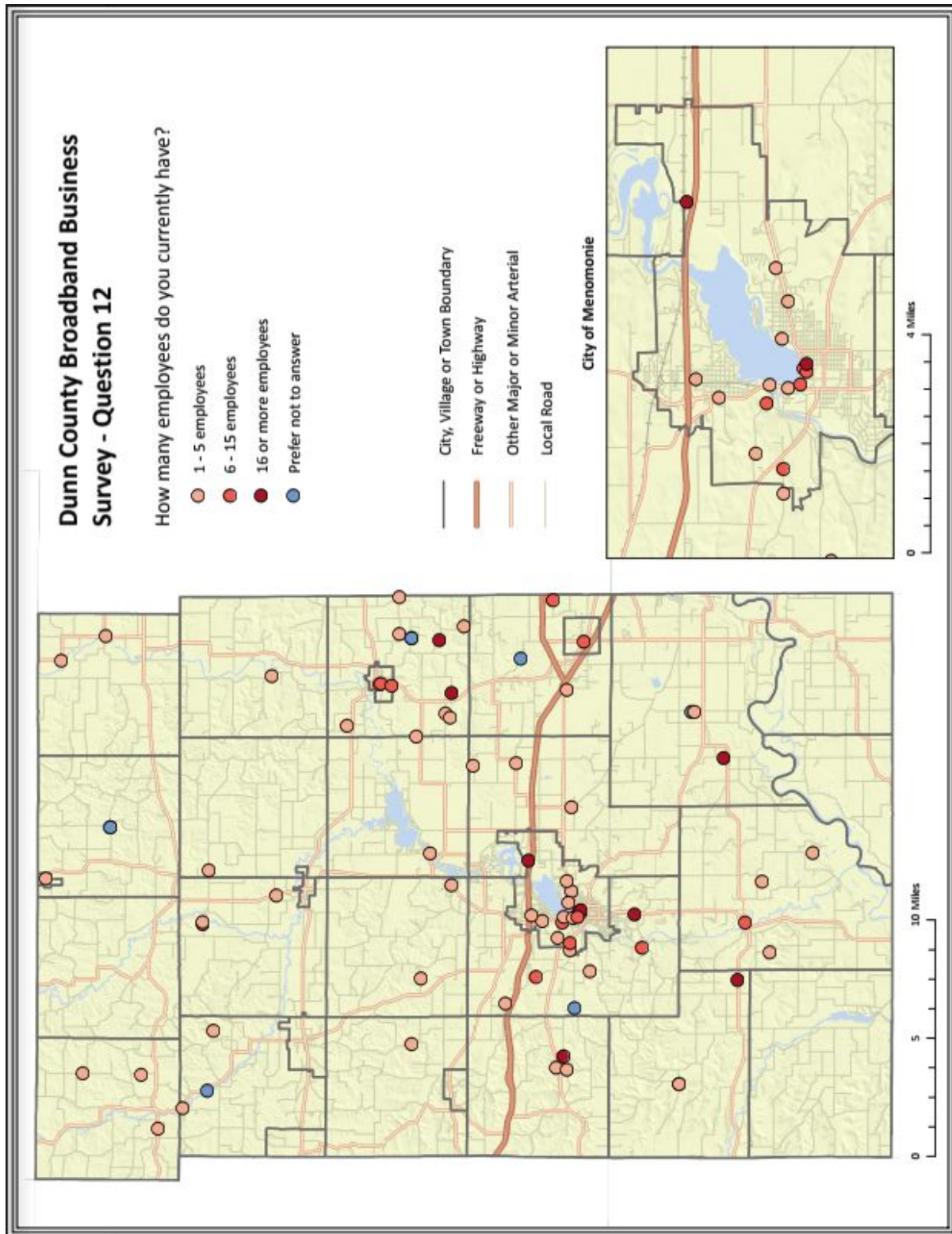
Appendix M. SRC Map Business Question 10: Do you own or rent the building you business is based out of?



Appendix N. SRC Map Business Question 11: What is the maximum you would be willing to pay for high speed Internet (with a minimum download speed of 25Mbps and 3Mbps upload - per federal definition)?



Appendix O. SRC Map Business Question 12: How many employees do you currently have?



Appendix P. Dunn County Broadband/Internet Survey for RESIDENTS (Updated)

Dunn County Broadband/Internet Survey for RESIDENTS

Please return by July 21st, 2017

Survey Purpose: Information collected will be used to assist in determining the broadband needs and gaps for Dunn County's business. Obtaining feedback from Dunn County community members and businesses is vital to the preliminary review process. Let your voice be heard.

Broadband Definition: Essentially, 'broadband' is a word used to describe a highly common way of connecting your computer or other electronic devices (phones, tablets, etc..) to the internet. Broadband replaces the original 'dial-up' method to connect to the internet which is a much slower process. Broadband includes several high-speed transmission technologies such as Digital Subscriber Line (DSL), Cable Modem, Fiber, mobile broadband (3G or 4G mobile phone signal), Satellite, and Broadband over Powerlines (BPL). For all intents and purposes broadband is your Internet connect.

Results Use: Results will be used in two ways: (1) locations will be mapped to show unmet needs or demand for high speed Internet and (2) submissions will be used to communicate need to potential providers. Your participation in this survey is VOLUNTARY and the responses you provide are CONFIDENTIAL. We ask that you provide your address along with your township information so we can begin to map areas with gaps in broadband/internet service in Dunn County. Your actual address information will not appear on the map we develop, just a general marker showing need. At the conclusion of the survey, only summary findings will be generated and reported. However, if you still feel uncomfortable providing this information you can choose to opt out of this specific question.

Please check the appropriate answer and read the directions carefully.

<p>1.) Do you currently have access to Broadband/Internet service at your home?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No / I am no sure</p> <p>If you checked option "No / I am not sure" please skip to question #16 on page 3.</p> <p>2.) How satisfied are you with your current Broadband/Internet service at home? Please check <u>one</u> option below.</p> <p><input type="checkbox"/> Extremely Dissatisfied <input type="checkbox"/> Moderately Dissatisfied <input type="checkbox"/> Slightly Dissatisfied <input type="checkbox"/> Neutral <input type="checkbox"/> Slightly Satisfied <input type="checkbox"/> Moderately Satisfied <input type="checkbox"/> Extremely Satisfied</p> <p>If you checked "Slightly Satisfied", "Moderately Satisfied", or "Extremely Satisfied" please skip to question #4</p> <p>3.) If you are dissatisfied or feel neutral with your current Broadband/Internet service, please indicate your reasons why you are dissatisfied. Please select <u>all</u> that apply.</p> <p><input type="checkbox"/> Browsing on the Internet is too slow (going page to page) <input type="checkbox"/> File downloads/uploads take too long <input type="checkbox"/> Photo downloads/uploads take too long <input type="checkbox"/> Video downloads/uploads take too long <input type="checkbox"/> Streaming video quality is jerky/not good <input type="checkbox"/> Service is too expensive <input type="checkbox"/> Other, please explain: _____</p>	<p>4.) Who is your current Broadband/Internet provider? Please select <u>one</u> option below.</p> <p><input type="checkbox"/> American Broadband <input type="checkbox"/> AT&T <input type="checkbox"/> CenturyLink <input type="checkbox"/> Charter / Spectrum <input type="checkbox"/> Clear Lake Telephone <input type="checkbox"/> Mcloud <input type="checkbox"/> Mosaic Telcom <input type="checkbox"/> MetTel <input type="checkbox"/> West Wisconsin Telcom <input type="checkbox"/> Other, please indicate here: _____</p> <p>5.) Which of the following most represents your current Broadband/Internet service at your home? Please select <u>one</u> option below.</p> <p><input type="checkbox"/> Dial-Up <input type="checkbox"/> DSL (Digital Subscriber Line) <input type="checkbox"/> Cable Modem <input type="checkbox"/> Satellite <input type="checkbox"/> Wireless <input type="checkbox"/> Unsure / Do not know</p> <p>6.) How long have you had Broadband / Internet service at your current home, from any provider? Please select <u>one</u> option below.</p> <p><input type="checkbox"/> Less than 1 year <input type="checkbox"/> At least 1 year but less than 3 years <input type="checkbox"/> At least 3 years but less than 6 years <input type="checkbox"/> 6 or more years</p>
---	---

Dunn County Broadband/Internet Survey for RESIDENTS

Please return by July 21st, 2017

7.) Approximately, what is your current monthly cost for Broadband/Internet service?
Please select one option below.

- Less \$50
- \$51 - \$75
- \$76 - \$100
- \$101 - \$125
- \$126 or more
- Unsure / Do not know

8.) What is the advertised Internet download speed in megabits per second (mbps) for your current Broadband/Internet services at your home?
Please select one option below.

- 1-4 Mbps
- 5-9 Mbps
- 10-24 Mbps
- 25-99 Mbps
- 100 + Mbps
- Unsure / Do not know

9.) The Federal Communications Commission (FCC) defines Broadband/High Speed Internet as a connection with a minimum download speed of 25 mbps and 4 mbps upload.

What is the maximum you would be willing to pay for high speed internet (with a minimum download speed of 25 mbps and 4 mbps upload - per federal definition)?

Please select one option below.

- Less than \$39.99 per month
- Between \$40 and \$49.99 per month
- Between \$50 and \$59.99 per month
- Between \$60 and \$69.99 per month
- Between \$70 and \$79.99 per month
- \$80 or more per month
- Unsure / Do not know

10.) Approximately, how many people (including yourself) utilized Broadband/Internet services at your home, within the last year?

Please indicate how many people from each age group have used Broadband/Internet services at your home below. Check one option for each age grouping.

	0	1	2	3	4	5+
Children (to age 12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teens (13-19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adults (20-35)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adults (36-60)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adults (61 and over)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11.) What is the most common/frequent way you currently use Broadband/Internet at your home?

Please rank the following options in order of frequent use from 1 – 8 by filling in the blank. 1 being the most frequent use and 8 being the least frequent use or no use.

- _____ Email
- _____ Shopping
- _____ Social Networking
- _____ Distance Learning/Education
- _____ Downloading Music or Videos
- _____ Reading news, blogs, etc...
- _____ Farming/Agriculture
- _____ Other, please explain: _____

12.) At your home, which of the following devices do you currently access Broadband/Internet services from? Please click all that may apply.

- Computer
- Smart Phone
- Tablet Computer
- TV
- Blue Ray/DVR/DVD
- Gaming Systems
- Appliances
- Security System
- Other, please indicate here: _____

Dunn County Broadband/Internet Survey for RESIDENTS

Please return by July 21st, 2017

13.) What are some things that you would like to do at home, that you are currently unable to do with your current broadband access?
Please click all that may apply.

- Send Pictures/Videos
- Take Online Courses
- Watch TV/Movies
- Online gaming
- Telemedicine
- Start/Operate Home Based Business
- Access Agriculture Information
- I do not have issues with my current internet service
- Other, please indicate here: _____

14.) Please indicate if someone (including yourself) in your household currently runs a home-based business or telecommutes at your home.
Please select yes or no below.

	Yes	No
Myself, or someone in my household currently runs a home-based business	<input type="radio"/>	<input type="radio"/>
Myself, or someone in my household currently telecommutes	<input type="radio"/>	<input type="radio"/>

15.) Please indicate if someone (including yourself) in your household plans to run a home-based business or telecommutes at your home.
Please select yes or no below.

	Yes	No
Myself, or someone in my household plans to run a home-based business	<input type="radio"/>	<input type="radio"/>
Myself, or someone in my household plans to telecommutes	<input type="radio"/>	<input type="radio"/>

Please SKIP to QUESTION # 22 on page 4

16.) You selected 'No / I am not sure', that you have access to Broadband/Internet service at your home.

Please indicate why you do not currently have Broadband/Internet service at your home?

Please click all that may apply.

- Not Available
- Too Expensive
- No need for internet connection
- Lack of or limited skills/knowledge to use
- Lack of computer other device(s)
- Use in another location
- I am not sure if I have Broadband/Internet service at my home
- Other, please explain: _____

17.) The Federal Communications Commission (FCC) defines Broadband/High Speed Internet as a connection with a minimum download speed of 25 mbps and 4 mbps upload.

If you did have access, what is the maximum you would be willing to pay for high speed broadband/internet at your home (with a minimum download speed of 25 mbps and 4 mbps upload - per federal definition)?

Please select one option below.

- Less than \$39.99 per month
- Between \$40 and \$49.99 per month
- Between \$50 and \$59.99 per month
- Between \$60 and \$69.99 per month
- Between \$70 and \$79.99 per month
- \$80 or more per month
- Unsure / Do not know

18.) Which of the following devices that you own, would you use at your residence if sufficient, affordable high speed internet were available?

Please click all that may apply.

- Computer
- Smart Phone
- Tablet Computer
- TV
- Blue Ray/DVR/DVD
- Gaming Systems
- Appliances
- Security System
- Other, please indicate: _____

Dunn County Broadband/Internet Survey for RESIDENTS

Please return by July 21st, 2017

19.) If you had sufficient and affordable Broadband/Internet access, what would be the most common and frequent way you would use the internet at home?

Please rank the following options in order of hypothetical frequent use 1 being the most frequent use and 8 being the least frequent use or no use. If you would not use Broadband/Internet at home even if it was available, simply rank that option as 1 and leave the rest blank.

- _____ Email
- _____ Shopping
- _____ Social Networking
- _____ Distance Learning/Education
- _____ Downloading Music or Videos
- _____ Reading news, blogs, etc...
- _____ Farming/Agriculture
- _____ Other, please explain: _____
- _____ I would not use Broadband/Internet at home even if it was available

20.) If sufficient and affordable broadband service were available at your home, approximately how many people (including yourself) would utilize the service?

Please indicate how many people from each age group would use Broadband/Internet services at your home if it were available below. Select one option for each age grouping.

	0	1	2	3	4	5+
Children (to age 12)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teens (13-19)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adults (20-35)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adults (36-60)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adults (61 and over)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

21.) If broadband services were available at your residence, please indicate if someone in your household would plan to start a home-based business or telecommute? Please select yes or no below.

	YES	NO
Home-Based Business	<input type="radio"/>	<input type="radio"/>
Telecommute	<input type="radio"/>	<input type="radio"/>

22.) Please provide your mailing address and the name of your township in the fields below.

Remember, your responses you provide are CONFIDENTIAL. We ask that you provide your mailing address along with your township information so we can begin to map areas with gaps in broadband /internet service in Dunn County. Your actual address information will not appear on the map we develop, just a general marker showing need. At the conclusion of the survey, only summary findings will be generated and reported. However, if you still feel uncomfortable providing this information you may skip this question.

Mailing Address: _____

Township: _____

23.) We want to hear all feedback on Broadband / Internet from Dunn County Residents!

Please use this field to address any other concerns or thoughts you have on Broadband/Internet services here:

Thank you for your time and valuable input,

Dunn County UW-Extension Office
 Dunn County Planning and Land Use Control Division
 Dunn County Economic Development Corporation

Please return this survey to the same place you picked it up. If you have any questions, contact Bob Colson at 715-231-6522.

Appendix R. Dunn County Broadband/Internet Survey for BUSINESSES (Updated)

Dunn County Broadband/Internet Survey for BUSINESSES

Please return by July 21st, 2017

Survey Purpose: Information collected will be used to assist in determining the broadband needs and gaps for Dunn County's business. Obtaining feedback from Dunn County community members and businesses is vital to the preliminary review process. Let your voice be heard.

Broadband Definition: Essentially, 'broadband' is a word used to describe a highly common way of connecting your computer or other electronic devices (phones, tablets, etc..) to the internet. Broadband replaces the original 'dial-up' method to connect to the internet which is a much slower process. Broadband includes several high-speed transmission technologies such as Digital Subscriber Line (DSL), Cable Modem, Fiber, mobile broadband (3G or 4G mobile phone signal), Satellite, and Broadband over Powerlines (BPL). For all intents and purposes broadband is your Internet connect.

Results Use: Results will be used in two ways: (1) locations will be mapped to show unmet needs or demand for high speed Internet and (2) submissions will be used to communicate need to potential providers. Your participation in this survey is VOLUNTARY and the responses you provide are CONFIDENTIAL. We ask that you provide your address along with your township information so we can begin to map areas with gaps in broadband/internet service in Dunn County. Your actual address information will not appear on the map we develop, just a general marker showing need. At the conclusion of the survey, only summary findings will be generated and reported. However, if you still feel uncomfortable providing this information you can choose to opt out of this specific question.

Please check the appropriate answer and read the directions carefully.

<p>1.) Do you currently have access to Broadband/Internet service at your business?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No / I am no sure</p> <p>If you checked option "No / I am not sure" please skip to question #9 on page 2.</p> <p>2.) How satisfied are you with your current Broadband/Internet service at business? Please check <u>one</u> option below.</p> <p><input type="checkbox"/> Extremely Dissatisfied</p> <p><input type="checkbox"/> Moderately Dissatisfied</p> <p><input type="checkbox"/> Slightly Dissatisfied</p> <p><input type="checkbox"/> Neutral</p> <p><input type="checkbox"/> Slightly Satisfied</p> <p><input type="checkbox"/> Moderately Satisfied</p> <p><input type="checkbox"/> Extremely Satisfied</p> <p>If you checked "Slightly Satisfied", "Moderately Satisfied", or "Extremely Satisfied" please skip to question # 4</p> <p>3.) If you are dissatisfied or feel neutral with your current Broadband/Internet service, please indicate your reasons why you are dissatisfied. Please select <u>all</u> that apply.</p> <p><input type="checkbox"/> Browsing on the Internet is too slow <small>(going page to page)</small></p> <p><input type="checkbox"/> File downloads/uploads take too long</p> <p><input type="checkbox"/> Photo downloads/uploads take too long</p> <p><input type="checkbox"/> Video downloads/uploads take too long</p> <p><input type="checkbox"/> Streaming video quality is jerky/not good</p> <p><input type="checkbox"/> Service is too expensive</p> <p><input type="checkbox"/> Other, please explain: _____</p>	<p>4.) Who is your current Broadband/Internet provider? Please select <u>one</u> option below.</p> <p><input type="checkbox"/> American Broadband</p> <p><input type="checkbox"/> AT&T</p> <p><input type="checkbox"/> CenturyLink</p> <p><input type="checkbox"/> Charter / Spectrum</p> <p><input type="checkbox"/> Clear Lake Telephone</p> <p><input type="checkbox"/> Mcloud</p> <p><input type="checkbox"/> Mosaic Telcom</p> <p><input type="checkbox"/> MetTel</p> <p><input type="checkbox"/> West Wisconsin Telcom</p> <p><input type="checkbox"/> Other, please indicate here: _____</p> <p>5.) Which of the following most represents your current Broadband/Internet service at your business? Please select <u>one</u> option below.</p> <p><input type="checkbox"/> Dial-Up</p> <p><input type="checkbox"/> DSL (Digital Subscriber Line)</p> <p><input type="checkbox"/> Cable Modem</p> <p><input type="checkbox"/> Satellite</p> <p><input type="checkbox"/> Wireless</p> <p><input type="checkbox"/> Unsure / Do not know</p> <p>6.) How long have you had Broadband / Internet service at your current business location, from any provider? Please select <u>one</u> option below.</p> <p><input type="checkbox"/> Less than 1 year</p> <p><input type="checkbox"/> At least 1 year but less than 3 years</p> <p><input type="checkbox"/> At least 3 years but less than 6 years</p> <p><input type="checkbox"/> 6 or more years</p>
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Dunn County Broadband/Internet Survey for Businesses

Please return by July 21st, 2017

7.) Approximately, what is your current monthly cost for Broadband/Internet service?

Please select one option below.

- Less \$50
\$51 - \$75
\$76 - \$100
\$101 - \$125
\$126 or more
Unsure / Do not know

8.) What is the advertised Internet download speed in megabits per second (mbps) for your current Broadband/Internet services at your home?

Please select one option below.

- 1-4 Mbps
5-9 Mbps
10-24 Mbps
25-99 Mbps
100 + Mbps
Unsure / Do not know

After Answering Question #8, please skip to question #10.

9.) You selected 'No / I am not sure', that you have access to Broadband/Internet service at my business for question #1.

Please indicate why you do not currently have Broadband/Internet service at your business?

Please click all that may apply.

- Not Available
Too Expensive
No need for internet connection
Lack of or limited skills/knowledge to use
Lack of computer other device(s)
Use in another location
I am not sure if I have Broadband/Internet service at my business
Other, please explain:

10.) Do you own or rent the building your business is based out of? Please select one option below.

- Own
Rent
Other, please explain:

11.) The Federal Communications Commission (FCC) defines Broadband/High Speed Internet as a connection with a minimum download speed of 25 mbps and 4 mbps upload.

What is the maximum you would be willing to pay for high speed internet (with a minimum download speed of 25 mbps and 4 mbps upload - per federal definition)?

Please select one option below.

- Less than \$39.99 per month
Between \$40 and \$49.99 per month
Between \$50 and \$59.99 per month
Between \$60 and \$69.99 per month
Between \$70 and \$79.99 per month
\$80 or more per month
Unsure / Do not know

12.) How many employees do you currently have?

Please select one option below.

- 1-5 employees
6-15 employees
16 or more employees
Prefer not to answer

13.) Have you ever considered moving your business out of Dunn County due to factors related to connectivity to Broadband? Please select one option below.

- Yes
No
Other, please explain:

14.) Please provide your mailing address and the name of your township in the fields below.

Mailing Address:

Two blank lines for mailing address input.

Township:

15.) We want to hear all feedback on Broadband / Internet services from Dunn County Residents!

Please use this field to address any other concerns or thoughts you have on Broadband/Internet services here:

Two blank lines for feedback input.

Thank you for your time and valuable input,

If you have Please return this survey to the same place you picked it up. If you have any questions, contact Eric Turner at 715-232-4009.

Appendix S. Dunn County Residential and Business High-speed Internet Needs Assessment
Survey Report by the UW-River Falls Survey Research Center



**Dunn County Residential and Business
High-Speed Internet Needs Assessment
Survey Report**

**James Janke
David Trechter**

Survey Research Center Report 2017/22
September 2017

Staff and students working for the Survey Research Center (SRC) at UW-River Falls were instrumental in the completion of this study. We would like to thank Denise Parks, Shelly Hadley, David Jacobson, Aaron Leiby, Rachel Shamro, and Beth Zimmer. We gratefully acknowledge their hard work and dedication.

The SRC would also like to thank the following people for their guidance and input: Stephanie Hintz & Jason Hausler (UW-Extension), Bob Colson & Addison Vang (Environmental Services Department), and Eric Turner & Cherie Haglund (Dunn County Economic Development Corporation).

Finally, we would like to thank the residents and business owners of Dunn County who took time to complete a questionnaire.

Table of Contents

Executive Summary 3

Survey Purpose 6

Survey Methods 6

Current Internet Service..... 7

Satisfaction with Internet Service 9

Internet Service Information and Provider 12

Internet Activities 23

Business Internet Activities 32

Open Ended Comments - Residential..... 53

Conclusions - Residential 55

Business Responses 56

Open Ended Comments – Business Respondents..... 76

Conclusions - Business..... 77

Appendix B1 – Residential Written Responses..... 78

Appendix B2 – Business Written Responses..... 152

Appendix C1- Quantitative Responses by Question (Residential)..... 157

Appendix C2 - Quantitative Responses by Question (Business)..... 161

Executive Summary

The purpose of this study was to gather input from residents and businesses about internet service in Dunn County. In June 2017, Dunn County Community Resources & Tourism Committee (CR&T) launched an online survey that was open to all residents and business owners who desired to respond. Separate versions were created for residents and businesses. Paper versions of both surveys were available for those without internet access. Dunn County CR&T chose to have the Survey Research Center at the University of Wisconsin-River Falls tabulate and analyze the data and prepare a written report.

Residential Survey Responses

Three fourths of respondents said they have internet service (Chart 1).

Over half of respondents are at least somewhat dissatisfied with their internet service; 24% are extremely dissatisfied. Those who are satisfied comprise 44 percent of the responses, with the largest percentage (25%) being moderately satisfied (Chart 2).

Respondents who are dissatisfied with their internet service report multiple reasons for their dissatisfaction. The most frequent are slow browsing, poor video streaming, their monthly bill, and slow downloads and uploads of files (Chart 3).

Among the internet service providers, Charter/Spectrum and CenturyLink have the largest market shares, with about 30 percent each (Chart 4).

The most frequent technology to deliver the internet is DSL (32%) followed by cable modem (27%), wireless (21%), and satellite (13%) (Chart 5).

Nearly six in ten respondents have had internet service for at least six years (Chart 6).

The largest percentage of respondents pay between \$51 and \$75 per month for their internet service (Chart 7).

Many respondents do not know the advertised speed of their internet connection (43%). Among those who know their speed, the largest portion reported their speed to be between 25 Mbps and 99 Mbps (Chart 8).

A quarter of respondents said they would pay no more than \$39.99 per month for high-speed (25+ Mbps) internet services, and an additional quarter of respondents would pay no more than \$49.99 (Chart 9).

With respect to the current number of household internet users and their age group, 32 percent have children under age 14, 29 percent have teens age 13-19, 37 percent have adults age 20-35, 66 percent have adults 36-60, and 40 percent have adults over age 60. (Table 1).

Email is the most frequent internet use among respondents, followed by social networking, shopping and reading news, blogs, etc. (Chart 10).

Nearly all respondents said they have a computer (95%), followed closely by 87 percent with smart phones (Chart 11).

When asked about internet activities they would like to do but cannot do with their current internet connection, three in four respondents said they would watch TV/movies and 44 percent would send pictures/videos (Chart 12).

One in five respondents currently telecommute, and 17 percent currently operate a home-based business (Chart 13). Twenty-three percent said they have household members who plan to telecommute, and 20 percent have plans to run a home-based business (Chart 14).

The most common reported reason for not having internet was that it is not available at their place of residence (78%), followed in a distant second place by the expense (14%) (Chart 15). A quarter of non-subscribers would pay no more than \$39.99 per month for high-speed internet service and another quarter would pay no more than \$49.99 (Chart 16).

The most common devices that non-subscribers would use to connect to the internet include a computer (96%), smart phone (89%), TV (78%), and tablet computer (77%) (Chart 17).

Non-subscribers were asked to identify the most important internet activities they would use if they had affordable high-speed internet. Email ranked in first place, followed by social networking, shopping, and distance learning (Chart 18).

With respect to the potential number of household internet users and their age group among non-subscribers, 57 percent have children under age 14, 54 percent have teens age 13-19, 66 percent have adults age 20-35, 83 percent have adults 36-60, and 69 percent have adults over age 60 (Table 2).

Four in ten non-subscribers would telecommute if they had internet service. More than a third would start a home-based business (Chart 19).

Business Survey Responses

Three fourths of respondents said they have internet service (Chart 20).

More than six in ten respondents said they are at least somewhat dissatisfied with their internet service, with the largest portion (31%) being extremely dissatisfied. Those who are satisfied comprise 40 percent of the responses, with the largest percentage being moderately satisfied (17%) (Chart 21).

Half of respondents use a DSL connection to the internet. Cable technology is a distant second (22%) (Chart 23).

Three-fourths of respondents have had internet service for at least six years (Chart 24).

The largest percentage of respondents pay between \$51 and \$75 per month for their internet service (31%), followed by 27 percent who pay over \$125 (Chart 25).

Many respondents do not know the advertised speed of their internet connection (32%). Among those who know their speed, the largest portion reported their speed to be between 25 Mbps and 99 Mbps (20%) (Chart 26).

Among business respondents without a current internet connection, a large majority said the most common reported reason was that internet is not available at their place of business (85%) (Chart 27).

When asked how much they would pay per month for high-speed internet service, the largest percentage of respondents said they would pay \$50 to \$59.99 (21%), followed by 17 percent who would pay less than \$40, and 16 percent who would pay \$40 to \$49.99 (Chart 28).

More than eight in ten respondents own their place of business (Chart 29), and two-thirds have no more than five employees (Chart 30)

One in five business owners have considered moving their business out of Dunn County due to factors related to internet connectivity (Chart 31).

To view the full document, please visit the Dunn County Website (<http://www.co.dunn.wi.us/>) or use the following link to directly access the document: <http://bit.ly/2E3ni11>.

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