

# Sherburne County Broadband Feasibility Study Report



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## **Background**

Rural areas of Minnesota and, for the most part, rural areas throughout the United States served by publicly traded, for-profit corporations lack ubiquitous broadband services. Generally, these companies do a good job of providing broadband services in larger communities and urban areas that have higher populations densities but the further away one moves from these areas the less available broadband services become.

Sherburne County, located in central Minnesota between St Cloud and the Twin City metropolitan area, exemplifies this observation. The southern and eastern regions of the county that include the U.S. Highway 10 and 169 corridors, respectively are marked by urban areas including the cities of Becker, Big Lake, Elk River and Zimmerman that comprise over 48% of the county's population while only accounting for about 15% of the area. These communities, while still lacking broadband access in some parts, typically have multiple providers including the incumbent telephone companies and cable television providers. The rest of the county, however, has far fewer options for broadband service with some areas having no viable options. Furthermore, the county is looking to connect anchor government facilities with fiber-based broadband services. This fiber middle-mile or core network would also serve as the backbone for providing countywide broadband services. For these reasons, Sherburne County has engaged Compass Consultants Inc. to conduct a Broadband Feasibility Study to analyze the possible alternatives to connect government facilities with fiber-based services and provide the residents of the county with ubiquitous broadband services.

CC & I Engineering, Inc., dba Compass Consultants Inc., is a full service communications engineering consulting company providing services to traditional and new organizations desiring to improve or start any form of communications system in the upper Midwest.

Why is it that rural areas have such poor broadband service coverage? Simply, it is not profitable to provide phone service to rural areas and broadband services cost even more to provide, requires fiber optic cable to be constructed deeper into the network and the existing copper infrastructure may not be fully depreciated. In the past, universal service was the national policy of all telephone companies. A Universal Service Fund (USF) was established to meet the goal for universal service. The fund was used to help rural service providers recover their costs to provide services in areas that cost more to serve than the national average. The Federal Communications Commission (FCC) has started a process to migrate USF to fund broadband services targeting the unserved and underserved rural areas. The process will take many years to reach 90% of the unserved rural markets.

Rural areas without broadband services are at a severe disadvantage when it comes to attracting new businesses, keeping existing businesses, and all forms of economic development. Furthermore, residents in areas with limited broadband services lack access to remote services such telehealth and distance learning opportunities. For these reasons, these areas tend to experience negative migration of people in the 18-45 age group.

What can Sherburne county do to provide ubiquitous broadband services? The options analyzed in this study are:

1. **Middle Mile Fiber Optic System** – Middle mile fiber optic system is a fiber network with the main purpose of connecting end user networks to the main, or core, network. In Sherburne county, this fiber network would be utilized to connect core government and anchor facilities, such as schools, hospitals and libraries with a high bandwidth, high capacity network. It would also be the first step in constructing a county-wide broadband last mile network.
2. **Fiber-to-the-Home (FTTH)** – FTTH is a common name for broadband networks where optical fiber is run all the way to the home or premise occupied by the subscriber. Optical fiber provides superior broadband capabilities to the copper networks that were typically constructed in the 20<sup>th</sup> century. For this reason, FTTH is the preferred way to provide robust, “future ready” broadband services. Unfortunately, the costs of constructing a FTTH network make it difficult, if not impossible, to implement based solely on economic considerations. A business plan has been prepared to determine the level of grant and loan funding necessary to make the project feasible.
3. **Fixed Wireless** – Wireless networks are alternative way of providing broadband services. Fixed wireless system have a central transmit receive tower location that is capable of connecting to multiple homes. Wireless systems have the advantage of, once in service, being able to connect subscribers inexpensively and quickly as there is no physical construction requirements. However, terrain and other sources of interference may negatively impact performance of these networks. Also, the bandwidth of these networks is more limited in comparison to an all fiber network.

## **Rural Broadband in Sherburne County**

As already known by the county, access to broadband services in the rural areas of the county is lacking with many areas having no broadband access. Broadband access in the cities and urban areas of the county is adequate to good with speeds of up to 200 Mbps in some areas. However, even within areas of some of the communities, access to broadband services is limited or not available today.

Access to broadband services can have an important socio-economic impacts to communities and the lack of broadband services can hinder the economic growth of an area. Some of the issues that can arise from inadequate broadband services include:

- **Access to Services** – Services such as telehealth and distance learning are dependent on having broadband access. Such services are vital to the growth of rural areas. Telehealth allows people to have access to state-of-the-art medical facilities at their local medical clinic/hospital. This service can literally be the difference between life and death. Likewise, distance learning opportunities has impacts on multiple age groups.
- **Telecommuting** – More companies are allowing employees to work remotely from home and this trend will continue into the future. Allowing employees to work from home save companies money by reducing the office space requirements. Without access to broadband services, employees cannot take advantage of this growing part of the economy and the county possibly loses residents who must locate to areas that have broadband access.

- Home Values – Because, in part, of the reasons listed above, home values can be negatively impacted by the lack of broadband services. As individuals and families are looking for someplace to call home, they are increasingly shying away from areas that lack modern services such broadband access.

These effects of lacking broadband availability will only worsen into the future as younger generations, who view broadband as important as their grandparents viewed electricity, become adults looking for communities to move to.

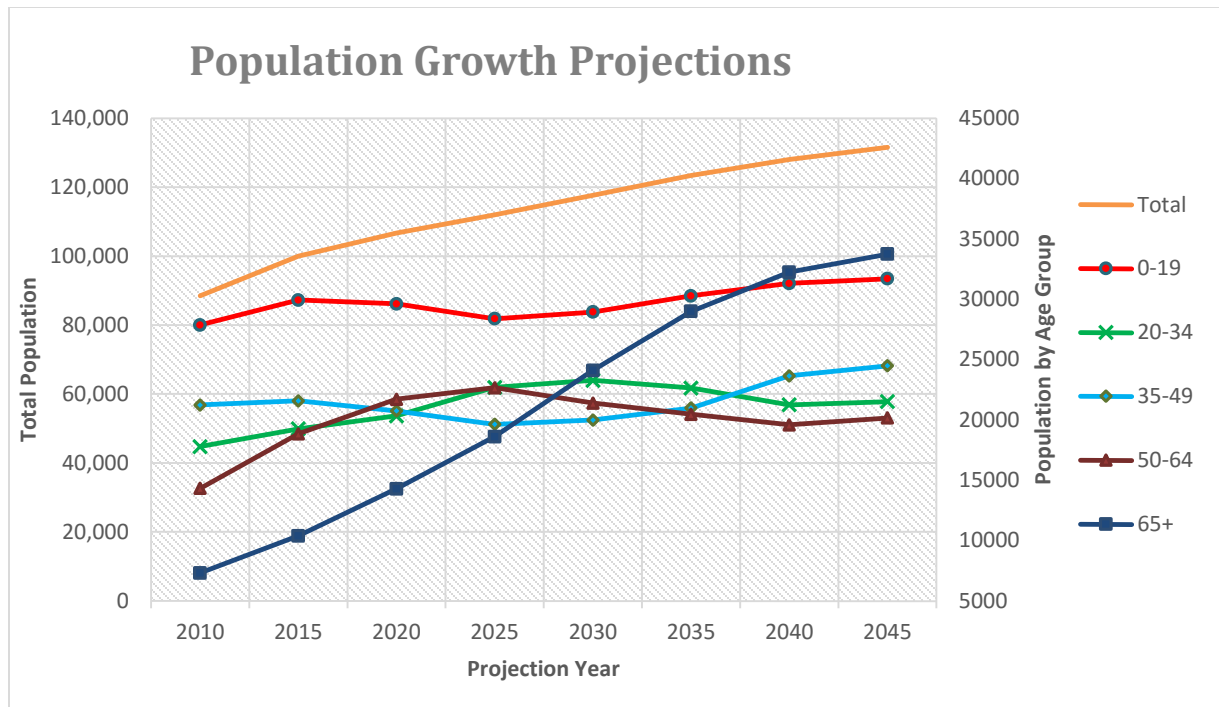
## **County Demographics**

The census data for Sherburne County show some interesting characteristics. Overall the population within the county has grown steadily since 1890 with an average annual growth rate of 2.28%. The population of the county was at 88,499 according to the 2010 census. The 2010 census also showed that the county had a total of 32,379 households. These statistics were used for engineering analysis for this feasibility study.

According to the Minnesota State Demographic Center ([www.mn.gov/admin/demography/](http://www.mn.gov/admin/demography/)), the population is expected to continue grow for the next 30 years at an annual growth rate, AGR, of 1.14% and is expected to be at about 131,000 by the year 2045. Within this growth, however, are some interesting statistics. As shown in Table 1 and in Figure 1, most age groups are expected to remain constant, with a growth rate of less than 1% with the exception of the over 65 age group which is anticipated to grow at an annual growth rate of almost 4.5%. The increase in this age demographic is important as it may be indicative of the aging of the residents in the county. People in this age group can benefit from improved access to broadband services in items such as telemedicine.

Age Group	2010	2015	2020	2025	2030	2035	2040	2045	Annual Growth Rate
0-19	27864	29,927	29,610	28,382	28,939	30,275	31,313	31,689	0.368%
20-34	17777	19,255	20,328	22,690	23,272	22,642	21,249	21,516	0.547%
35-49	21230	21,570	20,746	19,621	19,989	20,979	23,651	24,481	0.408%
50-64	14321	18,839	21,705	22,658	21,387	20,460	19,585	20,154	0.981%
65+	7307	10,384	14,278	18,607	24,096	28,995	32,242	33,744	4.468%
Total	88,499	99,975	106,667	111,958	117,683	123,351	128,040	131,584	1.140%

**Table 1: Sherburne County projected growth by age group**



**Figure 1: Sherburne County Population Projections**

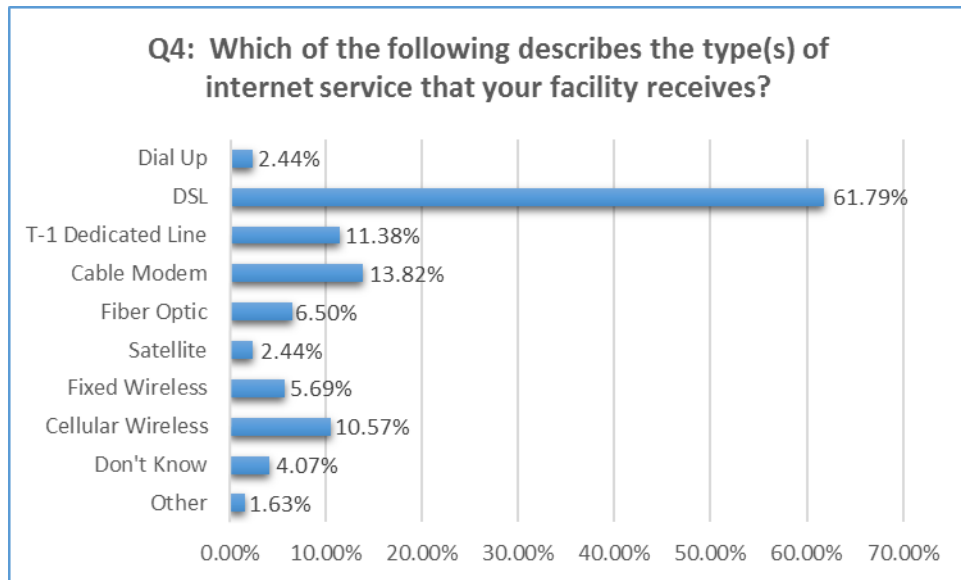
Insight into growth trends within the county can be gained by viewing trends based on location. As likely known to most, the majority of the population within Sherburne County is found in the communities along the Hwy 10 and 169 corridors accounting for approximately 57% of the population. Population density steadily decreases as one moves to the northwest part of the county with the townships along the northern border having fewest homes per square mile.

## **Business Questionnaire Review**

### **Key Survey Results**

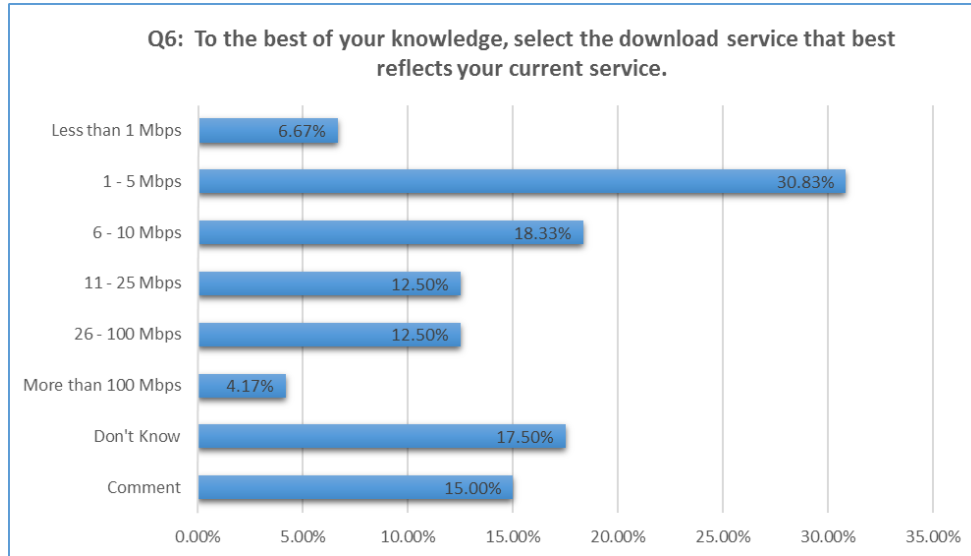
Sherburne County conducted a survey utilizing Survey Monkey, a web-based service. Through this survey, 123 businesses responded to the survey. Six keys responses shown below in Figures 2 through 7 illustrate various aspects of business broadband connectivity in Sherburne county.

Question 4, Figure 2, of the survey asked the respondents to identify what type of technology is used for broadband connectivity. The results show that most business are connected via DSL technology followed by cable modem, wireless technologies. This result may indicate to the nature of rate of connection for most businesses as DSL technologies typically have a top rate of 25 Mbps for businesses very near to the electronics site and quickly decreases as the distance increases.



**Figure 2**

Question 6 from the survey asked the respondents about the download speeds of their service. As seen in Figure 3, the results indicate that at least 68% of the respondents receive download speeds of 25 Mbps or less while only about 17% have download speeds of greater than 25 Mbps. This correlates to the results of Question 4.



**Figure 3**



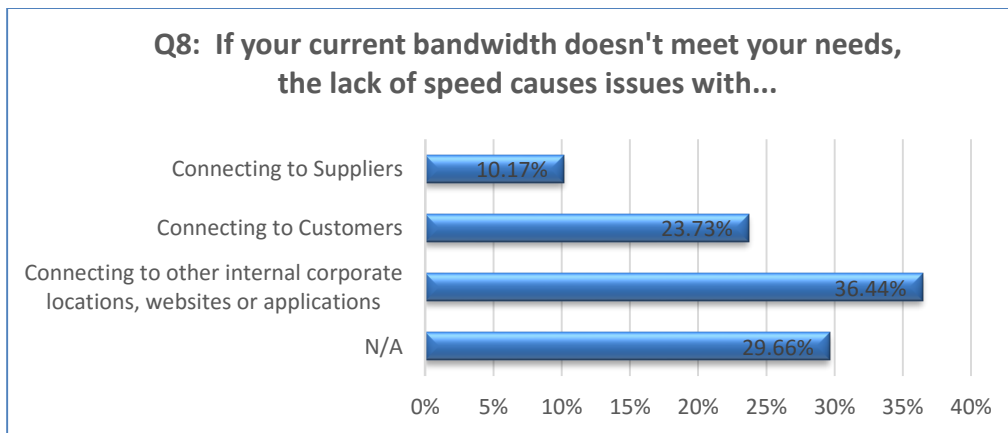
Question 7 from the survey asked respondents about their level of satisfaction based on the categories of bandwidth, price, and reliability. The results of this question, Figure 4, indicates that the level of satisfaction is low with about 52% of the respondents answering in the “Dissatisfied” or “Very Dissatisfied” categories for bandwidth and price satisfaction, and about 48% of the respondents answering in the “Dissatisfied” or “Very Dissatisfied” categories for reliability satisfaction.

**Q7: How would you rate your satisfaction with your primary broadband provider?**

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Total	Average Rating
<b>Bandwidth</b>	9.09% 11	22.31% 27	16.53% 20	24.79% 30	27.27% 33	121	3.39
<b>Price</b>	7.50% 9	13.33% 16	26.67% 32	26.67% 32	25.83% 31	120	3.5
<b>Reliability</b>	10.92% 13	18.49% 22	22.69% 27	20.17% 24	27.73% 33	119	3.35

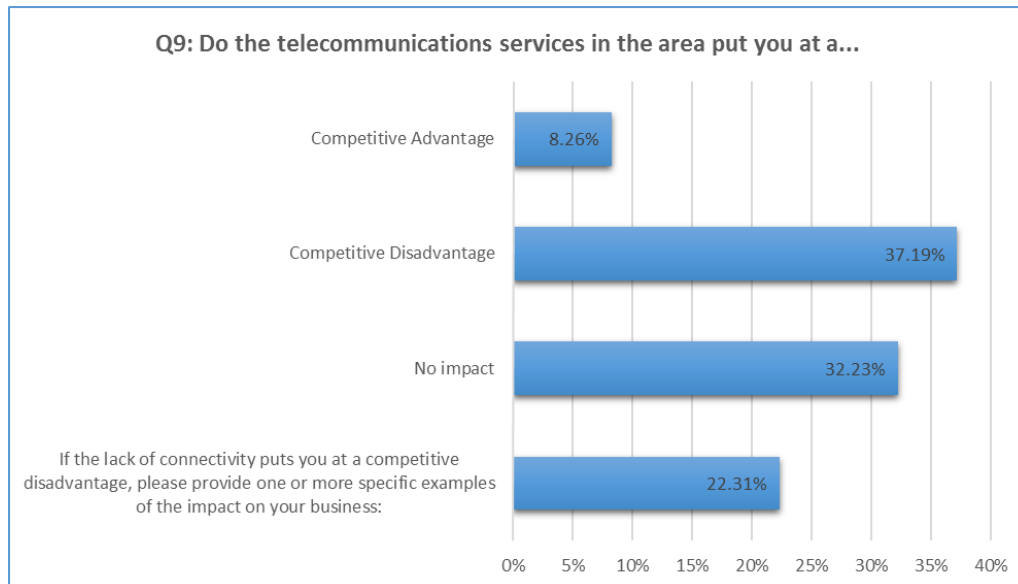
**Figure 4**

Question 8 from the survey shows that almost 25% of speed related issues impact the ability of customers to connect to business websites. This knowledge would likely have a negative impact on prospective businesses looking to call Sherburne County their home.



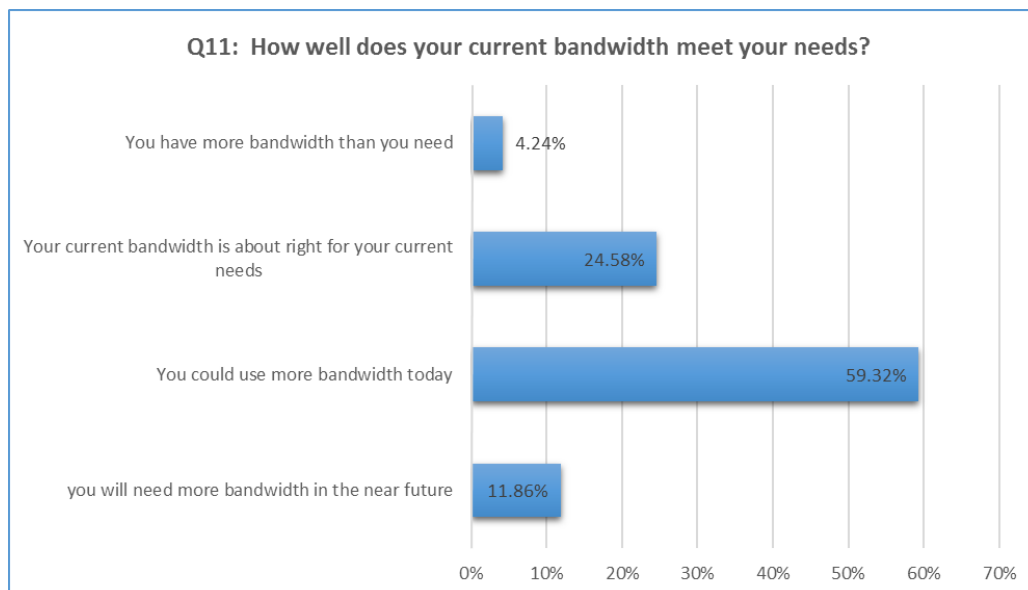
**Figure 5**

Question 9 from the survey asks respondents if their telecommunications services puts them at an advantage, disadvantage or no impact. The results show that 37% of the respondents answered that their telecommunications services places them at a disadvantage while only 8% respondent that their telecommunications services gives them an advantage.



**Figure 6**

Finally, the results of Question 11 indicate that the respondents are unsatisfied with their current level of broadband service bandwidth.



**Figure 7**

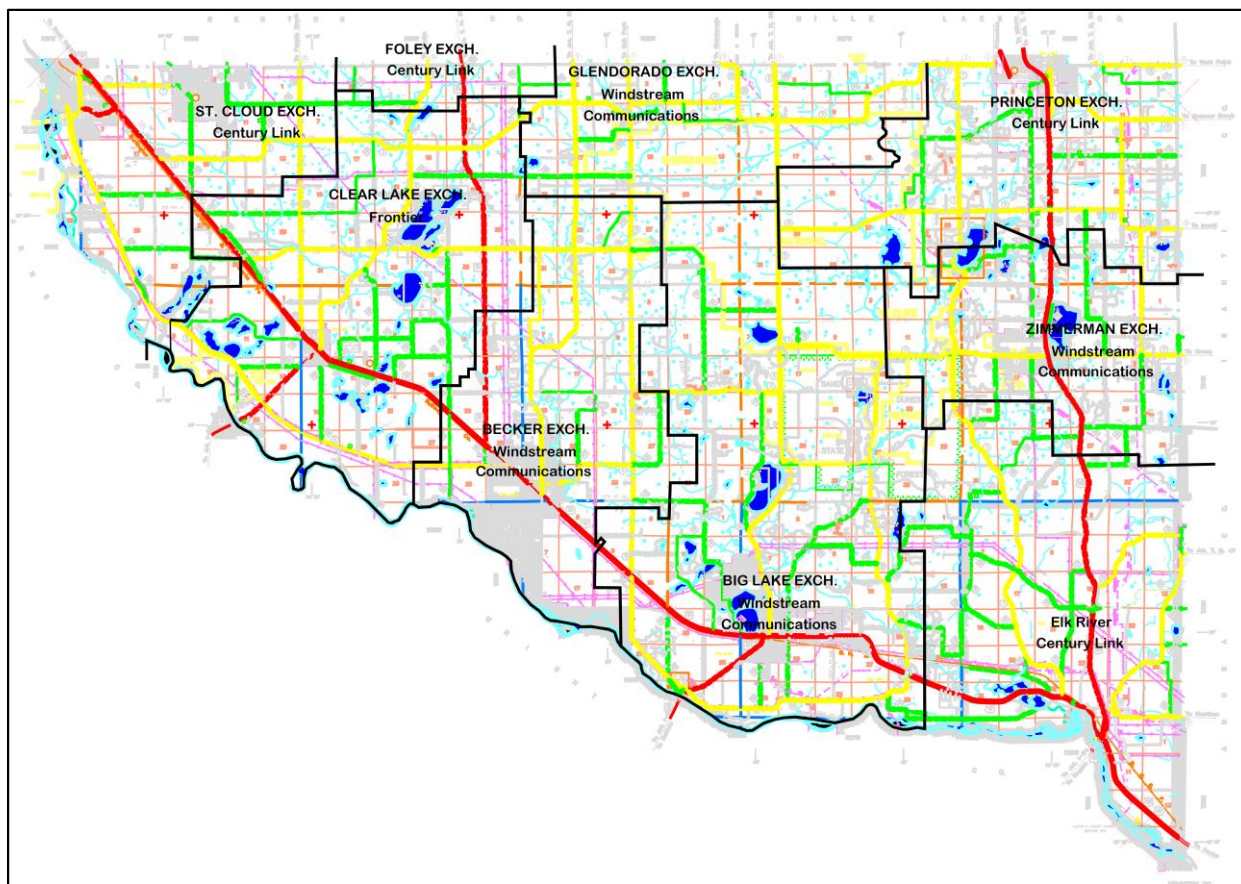
The results of the survey generally indicate that level of satisfaction of the business respondents is quite low and that the respondents believe that their business is impaired or limited by the current state of their broadband connection. On the other hand, there were no questions that indicate the likelihood of Sherburne county businesses purchasing new, advanced broadband services or what price businesses would likely be willing to pay.

## **Communications Providers**

### **Incumbent Telephone Providers**

There are three incumbent telecommunications providers that serve Sherburne County. The largest provider by area is Windstream Communications which serves the exchanges of Becker, Big Lake, Glendorado and Zimmerman. CenturyLink is the incumbent provider for the exchanges of Elk River, Foley, Princeton and St. Cloud. Frontier provides service to the exchange of Clear Lake.

The Minnesota Public Utility Map below (Figure 8) shows the boundaries of the incumbent telecommunications providers within Sherburne County.



**Figure 8: Sherburne County PUC Exchange Map**

Windstream Communications ([www.windstream.com](http://www.windstream.com)) is a publically traded company that has its headquarters in Little Rock, AR and is the ninth largest residential telephone provider in the United States with service covering more than 8.1 million people in 21 states. Windstream provides telephone and internet services to four exchanges that lie within or partially within Sherburne County. These exchanges include Becker, Big Lake, Glenderado and Zimmerman.

According to the ConnectMN website ([www.ConnectMN.org](http://www.ConnectMN.org)), Windstream currently provides broadband service with data rates of up to 25 Mbps within portions of the communities. Outside of the communities, Windstream still provides broadband to parts of its service areas but with speeds at or below 3 Mbps in most areas dependent on necessary facilities being in place.

According to the Windstream website, current residential service rates in Sherburne County range from \$49.99/mo. for up to 6 Mbps to \$59.99/mo. for up to 25 Mbps. Business services range from \$120.00/mo. for up to 10 Mbps to \$180/mo. for up to 100 Mbps where available. Windstream also provides voice and video services within its service areas.

CenturyLink, Inc. ([www.centurylink.com](http://www.centurylink.com)) is a publically traded company based out of Monroe, LA and is the third largest residential telephone provider in the United States with service in 36 states. CenturyLink provides telephone, internet and television services to the Elk River, Princeton, St. Cloud and Foley exchanges that lie within or partially within Sherburne County.

According to the ConnectMN website, CenturyLink currently provides broadband service with data rates of up to 25 Mbps within portions of the communities and select areas outside of the community of Princeton. Beyond the communities, CenturyLink still provides broadband to parts of its service areas but at lesser speeds dependent on necessary facilities being in place.

Based on information from the CenturyLink website, current residential service rates in Sherburne County range from \$29.99/mo. for service up to 7 Mbps. Business services in Elk River were also priced at \$29.99 for up to 7 Mbps with a three-year agreement. CenturyLink also provides voice and video services within its service areas.

Frontier Communications Corp. ([www.frontier.com](http://www.frontier.com)) is a publically traded company based out of Norwalk, CT and is the sixth largest residential telephone provider in the United States with service in 28 states. Frontier provides telephone, internet and television services to the Clear Lake exchange.

According to the ConnectMN website, Frontier currently provides broadband service with data rates of up to 25 Mbps within portions of the communities and select areas outside of the community of Princeton. Beyond the communities, CenturyLink still provides broadband to parts of its service areas but at lesser speeds dependent on necessary facilities being in place.

Based on information from the Frontier website, current residential service rates in Sherburne County range from \$24.99/mo. for up to 3 Mbps to \$54.99/mo. for up to 24 Mbps. Business services range from \$49.99/mo. for up to 7 Mbps to \$129.99/mo. for up to 40 Mbps where available. Frontier also provides voice and video services within its service areas.

## Competitors and Technologies

### Cable Television Providers

Midcontinent Communications ([www.midco.com](http://www.midco.com)) is a private company based out of Sioux Falls, SD that provides Coax and Fiber-based services in the states of Minnesota, North Dakota, South Dakota and Wisconsin. Midcontinent provides telephone, internet and television services to the Communities of Becker, Clear Lake, Princeton and Zimmerman. According to their website, Midcontinent provides broadband services with speeds of up to 200 Mbps at a price of \$99.95/mo.

Charter Communications ([www.charter.com](http://www.charter.com)) is a publically traded company with headquarters in Stamford, CT and is the fourth largest cable operator in the United States with service in 29 states. Charter provides telephone, internet and television services to the communities of Big Lake, Elk River and St. Cloud. According to their website, charter provides services starting at 60 Mbps for \$59.99/mo.

### Fixed Wireless Providers

Palmer Wireless ([www.palmerwireless.com](http://www.palmerwireless.com)) is a locally owned and operated company that provides high-speed wireless internet service, fixed voice and cellular service to central Minnesota including the northwestern part of Sherburne county. Palmer Wireless was recently awarded a DEED broadband grant to extend fiber services to 21 previously unserved businesses as well as a 70-acre industrial park in Becker, MN.

Airlink broadband ([www.airlinkbroadband.com](http://www.airlinkbroadband.com)) is a locally owned and operated company that provides high-speed wireless internet service to central Minnesota including the northwestern part of Sherburne county.

### Other Broadband Service Providers

Cellular Broadband - Sherburne county is served by the national carriers Verizon, Sprint, T-Mobile and AT&T as well as several additional resellers of cellular service such as Straight Talk Wireless as well as the locally owned Newcore Wireless LLC. (dba Duet Wireless and Palmer Wireless).

Broadband services via cellular technologies, while very convenient, is not always reliable in rural areas. First, wireless carriers tend to give priority to metropolitan areas for investments where there are more people to recover investment costs. Second, attenuation of signal strength is often at minimum levels in rural areas due to the distances covered by towers which leads to holes in services. This issue is further exacerbated by obstructions such as hills and foliage. Mobile broadband services are typically marketed based on data usage. Subscribers pay for an amount of data per month once exceeded, additional charges apply. Alternatively, some cellular providers market unlimited data usage but reduce or choke the download speed at a prescribed amount such as 2.5 Gb.

Satellite Broadband – There are several providers of satellite broadband services in Sherburne county including Hughes Networks, Exede Broadband, StarBand Communications and Skycasters. Similar to satellite television, satellite broadband typically has good coverage only requiring a clear path to the southern sky. Recent technology improvements have increased the maximum data speeds of satellite broadband. Similar to cellular data, satellite broadband packages are typically based on data usage





## Similar Projects

**Connect Anoka County** ([www.anokacounty.us/1531/Connect-Anoka-County](http://www.anokacounty.us/1531/Connect-Anoka-County)) - As part of the American Recovery and Reinvestment Act (ARRA) Broadband Opportunity Program. Anoka county partnered with Zayo Bandwidth, LLC ([www.zayo.com](http://www.zayo.com)), a privately owned company based out of Boulder, CO to construct, own and operate a 286-mile fiber network linking 145 governmental institutions within Anoka County.

The overall costs to construct the fiber network was little over \$19 million. In order to make the project feasible, Zayo applied for and received a NTIA grant in the amount of \$13,382,593 with Anoka County and Zayo Bandwidth each contributing about \$3 million.

Completed in 2013, Zayo will provide capacity services for the governmental network and separately offer connectivity services to the private sector. The grant will also provide dark fiber strands for Anoka County use through a Fiber Indefeasible Right to Use (IRU) agreement. Furthermore, the County is hopeful that at some point this fiber network will serve as the backbone to a county-wide FTTH project

**CarverLink** ([www.CarverLink.com](http://www.CarverLink.com)) – The CarverLink project is similar to the Connect Anoka County project but has some core differences. This project also utilized ARRA grant funds in order to construct a 122-mile fiber network to connect government and anchor facilities. The Carver County Open Fiber Initiative (CCOFI) received a \$6 million dollar NTIA grant and contributed an additional \$1.5 million to construct the fiber network. However, unlike Anoka county who utilized a project partner to own and operate the network, Carver County owns the fiber network itself and its partner Jaguar Communications operates the network and provides services to the private sector.

**RS Fiber** ([www.rsfiber.coop](http://www.rsfiber.coop)) – RS Fiber Cooperative is a broadband provider in Renville and Sibley counties that is currently in the construction stage of implementation. RS Fiber partnered with Hiawatha Broadband Communications Inc. ([www.hbci.com](http://www.hbci.com)) to construct and manage the fiber network. This project is being constructed in 2 phases. The first phase, costing about \$15 million, will construct a fiber network that connects the communities and their residences in the service area and is expected to be completed by the end of 2015. The second phase of the project will complete the fiber buildout to the remaining service area. In total the project is expected to cost about \$45 million and have the potential to serve 6,200 residents within the service area.

RS Fiber has received support from 10 cities and 17 townships in their service area who have/will raise collectively by the sale of a \$13.7 million Generally Obligated (G.O.) Tax Abatement Bond and using the funds to make an economic development loan to RS Fiber. RS Fiber will also borrow an additional \$42 million from various bank sources.

The cities and townships are assuming a certain amount of risk in this arrangement. Because the proceeds of the loan from the cities and townships come from a G.O. Tax Abatement Bond, each city and township must agree to obligate their authority to raise taxes to repay the bond if and only if the cooperative is unable to make the bond payment on their behalf.

## Potential Project Partners

As noted in the “Similar Projects” Section, most projects of this nature involve partnerships between public and private entities. These partnerships are typically formed for several reasons. First, a private communications partner has existing knowledge and infrastructure to provide the wide range of operation, administrative and maintenance services that the county would be looking for. Second, many grant opportunities are looking for such partnerships which increase the likelihood of a successful project. Third, these partnerships allow the private partner an opportunity to expand fiber network operations while minimizing risk.

Often, the public/private partnership involves a local cooperative or independent communications provider. However, in the case of Sherburne county, there no such providers. There are, however other providers in the area that may be interested in partnering with the county to provide advanced broadband services to county facilities and other public entities as well as private businesses. Three possible partners are discussed below.

**Zayo Bandwidth, LLC.** – Zayo is a privately owned company based out of Colorado Springs, Co. and is an international provider of fiber-based bandwidth infrastructure services and carrier-neutral colocation and interconnection services. Zayo has a large presence in the Twin Cities metropolitan area including the Connect Anoka County network. Zayo serves wireline and wireless carriers, data centers, internet content and services companies as well as federal, state and local government agencies.

**Arvig ([www.arvig.com](http://www.arvig.com))** - Arvig is an employee owned company based out of Perham, MN and has grown from a small family-owned telephone company to one of the largest independent telecommunications and broadband providers in the nation. Arvig provides advanced broadband services to business and residential customers across its 9,000 square mile service area that stretches across most of Minnesota.

**Hiawatha Broadband Communications Inc. ([www.hbci.com](http://www.hbci.com))** – HBC is a Winona-based company that was formed in 1997. HBC delivers telecommunications services to communities in southeastern Minnesota utilizing hybrid fiber and fiber-to-the-premise networks. HBC also provides wireless broadband in rural areas. Recently, HBC has partnered with RS Fiber to provide broadband services to communities in the counties of Renville and Sibley.

## Synergies and Sharing Opportunities

Many of the governmental units, NGO’s and other entities within Sherburne county could benefit from a county-wide broadband fiber network. This network would allow the county to consolidate its communications and broadband networks into a single network which could simplify the operation and management of the network and save the county money. Cities and townships could also benefit from this network both directly, by condensing network operations as well as providing higher quality services to public safety facilities, healthcare centers, schools, libraries and other entities, and indirectly by providing existing and potential private businesses with access to high-bandwidth, low-latency broadband services. Also, this network could provide backhaul from next-generation public safety network, called FirstNet, towers that would allow for advanced public safety features such as real-time



video and data directly from the scene of an emergency. Private communications companies could also utilize this network to improve services they provide including fiber-to-the-home services.

It is reasonable that each of the entities that could benefit from the construction of a fiber network could support the project. Similar to the RS Fiber project, cities and townships within Sherburne county could help support the construction of a fiber network through the sale of bonds or other means. If construction of the county network coincides with funding for development of FirstNet network, grant funding may be available to construct networks for backhauling of information from public safety towers. Schools and libraries may be able to utilize the Federal E-rate Telecommunications program, the Regional Library Telecommunications Aid and Telecommunications/Internet Access Equity Aid to provide support for the construction the fiber network.

## **Legal and Regulatory Issues**

There are many legal and regulatory issues that may impact the construction of county involved Fiber networks. While Compass isn't a legal firm and, therefore, cannot provide legal opinions discussion of possible issues is included.

The first issue to discuss is County Authority. It appears that there are no unanticipated restrictions to the county performing necessary work in the construction of a fiber network. The construction of a fiber network will need to conform to all state and federal requirements as well railroad right-of-way permits.

The next topic is ownership of the network. There are several ownership options that have been utilized by other government entities in Minnesota including private ownership, public ownership, cooperative and nonprofit ownership.

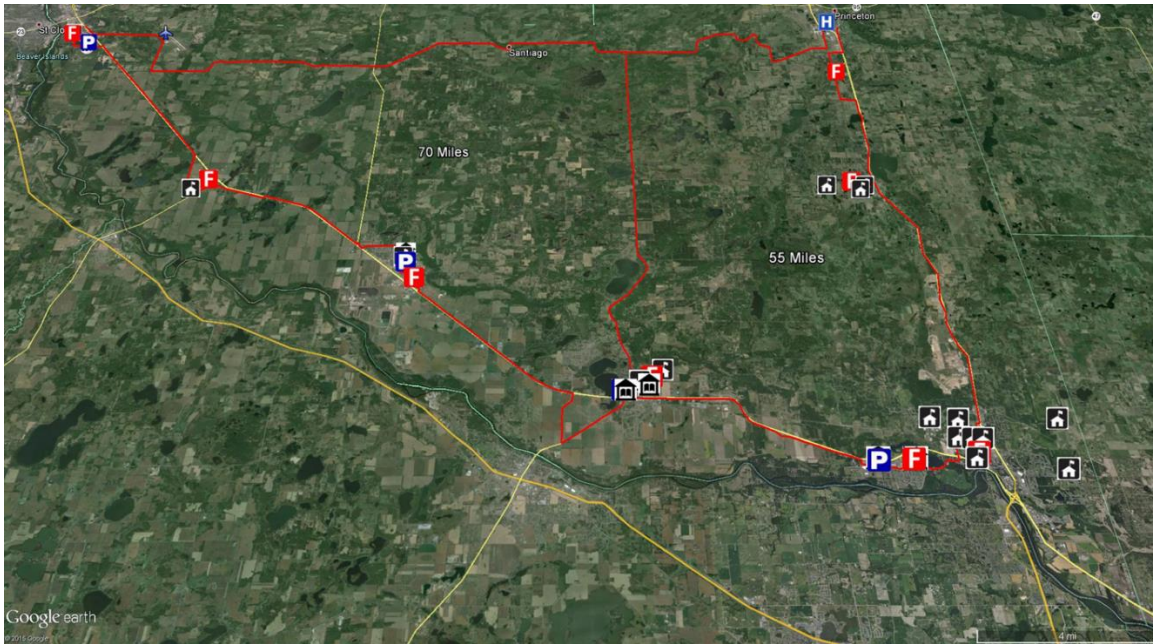
Each type of service to be provided has varying regulations that need to be kept in mind. The provision of internet services by public owned networks has been tested and upheld in the Minnesota Court of Appeals case *Bridgewater Telephone Company Inc. vs. City of Monticello* which established that municipalities have the legal right to provide internet services. The provision of telephone services by a publicly owned network requires a public referendum with 65% approval (Minnesota Statute 237.19). Finally, according to MN Statute 238.08, providers of video services are required to obtain and maintain franchise agreements from the local authorities.

Finally, the technology used to provide broadband services may impact requirements to operate. Wireless networks operating at 3.65 GHz are required to register with the FCC and obtain a non-exclusive license. Towers are also regulated and the construction of a new tower or collocating an antenna on an existing structure requires compliance with the FCC's rules for environmental review as well as receive approval from state or local governing authority, be in compliance with the National Environmental Protection Act (NEPA) and National Historic Preservation Act (NHPA). Tower construction may also require notification to the Federal Aviation Administration (FAA) and the FCC's Antenna Structure Registration (ASR).

## **Analyzed Options**

### **Middle-Mile Fiber Optic Network**

As part of this feasibility study, Sherburne County is looking to connect to government and anchor facilities with gigabit services that are ultimately scalable to 10 gigabit. Figure 10: shows the core fiber network as designed for this study as well as general locations of anchor facilities that were assumed to be connected to this network.



**Figure 10: Sherburne County Core Fiber Network**

This network would serve multiple purposes for the county. First, as mentioned, it will be used to connect government and anchor facilities with advanced, redundant broadband services. Second, it will serve as the transport network for residential broadband networks.

This network would also be able to provide services to many other governmental units, NGO's, Healthcare Facilities, schools and libraries as well have the potential to be utilized by private business and organizations. This

It is estimated that the cost to construct a middle-mile fiber network is \$6.93 million. This network, as estimated, would consist of approximately 110 miles of fiber construction, five sites for core electronics and 38 connected facilities. Table 2 shows the breakdown of these costs.

Pre-Design Buildout Estimates		Qty	Unit Cost	Total
Mainline OSP Construction		110 mi	\$ 27,500.00	\$ 3,025,000
Core Electronics Locations		5	\$ 350,000.00	\$ 1,750,000
Access Locations				
	Electronics	38	\$ 25,000.00	\$ 950,000
	Fiber Drops	7.2 mi	\$ 15,000.00	\$ 108,000
Miscellaneous (site prep, permits, etc.)		10%		\$ 583,300
Engineering		8%		\$ 513,304
Subtotal				\$ 6,929,604
Grand Total				\$ 6,929,604

**Table 2: Middle Mile Fiber Network Capital Requirements**

The two middle-mile projects discussed in the “Similar Projects” section both included grants that covered a large portion of the construction costs with the county and partners contributing lesser amounts. Without grant funding support, it may be difficult to make the economics feasible. In conversations with potential partners, the general consensus was that there was interest in such a project but that making a business case to construct such a network may be difficult. Looking at the Connect Anoka County project, the amount contributed by the grant and county combined for approximately 85% of the total project cost. At that level, it would be anticipated that the county and grant funding would need to be about \$6 million dollars to entice private partners.

### **Fiber-to-the-Home Network**

Compass performed a preliminary engineering design for a FTTH network that is capable of providing county-wide broadband services in order to understand the costs associated with construction of such a network. It should be noted that this design is not of a sufficient detail for construction purposes.

This design assumed the following:

1. GPON (Gigabit Passive Optical Network) service is proposed with all passive splitters located at access equipment locations. This arrangement allows for the savings of PON architecture while allowing for future bandwidth growth via active components and thus maximizes the future adaptability of the network.
2. Maximum loop length is 30km (or about 20 miles). Equipment sites were assumed at the same locations as core electronics locations for the core fiber network.
3. Construction costs are as follows:
  - a. Mainline OSP costs - \$27,500/mile rural, \$50,000/mile urban
  - b. Drop costs - \$15,000/mile rural and urban
4. A private provider(s) is(are) assumed to be providers and partners in the project but no agreement has been negotiated to provide services at this time. It is assumed that partner providers already provide broadband services and, therefore, no added costs for helpdesk, cloud

connection from the wire centers, and general overheads are included to implement FTTH services which can include data, voice, video and other IP based services.

5. 50% of all non-seasonal households will subscribe to broadband services.
6. With limited available information on the existing fiber in the county, no existing fiber was utilized in the engineering design.
7. Service life for all fiber cable should be 25 to 30 years, but equipment life may be only 10 to 15 years, and may need to be changed out in as few as 7 years to provide additional speed that may be required by subscribers.
8. All costs are in 2015 dollars. Inflation mostly affect labor which has been increasing slowly, but Moore's law has equipment costs either trending down or flat with increased speed and features.

The preliminary design was completed on a township basis and separated into rural and urban areas in order to perform sensitivity analysis of constructing a rural only network versus a complete, county-wide network.

### **Capital Requirements**

There are two main input parameters that are needed to project the cost to implement a FTTH system. The first is the number of miles of plant needed to construct the fiber to feed each and every customer. The miles are measured on the map and are tabulated by each township and shown on the chart below. The other input is the number of projected Customers to install. These are also tabulated based on the number of taxable land parcels multiplied by the projected take rate for permanent, year around households. Table 3 below contains cost for a project take rate of 50%

# FTTH Model

## Total Homes and Businesses

Total  
Business  
Residential

Take Rate	Rural	Urban	Total
	14178	16769	30,947
50%	414	739	1,153
50%	13764	16030	29,794

DROPS				
Subscriber drops		7259	8681	15,940
Feet/drop		500	350	
Miles	5280	687.41	575.45	1,262.85

Services		Take Rate	Rural	Urban	Total
	Highspeed	Bus + 10% Res	1,749	2,267	4,016
	Regular	50% Res	5,510	6,414	11,924
		100%	7,259	8,681	15,940

Total FTTH OLT SITES		Rural	Urban	Total
		0	5	5

Pre-Design Buildout Estimates	1266.5	Cost/v Miles>	1122	144.5	Total
Mainline OSP Construction		\$27,500 / \$50,000	\$ 30,855,000	\$ 7,225,000	\$ 38,080,000
OLT equipment (located in CO)		\$ 50,000.00	\$ -	\$ 250,000.00	\$ 250,000
GPON Equipment at OLT Sites		\$ 150.00	\$ 1,088,850.00	\$ 1,302,150.00	\$ 2,391,000
Costs per Home or	Fiber Drops	\$ 15,000.00	\$ 10,311,079.55	\$ 8,631,676.14	\$ 18,942,756
	ONT	\$ 385.00	\$ 2,794,715.00	\$ 3,342,185.00	\$ 6,136,900
	Inside Wiring	\$ 200.00	\$ 1,451,800.00	\$ 1,736,200.00	\$ 3,188,000
	Activation	\$ 150.00	\$ 1,088,850.00	\$ 1,302,150.00	\$ 2,391,000
				-	
Miscellaneous (site prep, permits, etc.)	15%		7,138,544	3,568,404	\$ 10,706,948
Engineering	10%		5,472,884	2,735,777	\$ 8,208,660
Subtotal			\$ 60,201,723	\$ 30,093,542	\$ 90,295,264
					\$ 90,295,264

**Table 3: FTTH Network Capital Requirements**

## Fixed Wireless Broadband

Compass performed a preliminary engineering design for a fixed wireless network capable of providing broadband services to most of the rural subscribers in order to understand the costs associated with construction of such a network. It should be noted that this design is not of a sufficient detail for construction purposes.

This design assumed the following:

1. Each Radio location is assumed to cover no more than 45 square miles (a circle with a radius of 3.75 miles).
2. All wireless equipment utilizes the 3.65 GHz frequency spectrum. This spectrum has a licensing requirement which will help with engineering the system and mitigating any interference issues within this frequency.
3. Fiber costs are assumed to consist of 5 miles per tower location for backhaul purposes.
4. Construction costs are as follows:

- a. Wireless equipment costs – \$125,000/site
  - b. Tower/Hut costs - \$300,000/site
  - c. Wireless installation and Customer Premise Equipment (CPE) costs - \$950/residence
  - d. Mainline OSP costs - \$27,500/mile rural
5. A private provider(s) is(are) assumed to be providers and partners in the project but no agreement has been negotiated to provide services at this time. It is assumed that partner providers already provide broadband services and, therefore, no added costs for helpdesk, cloud connection from the wire centers, and general overheads are included to implement fixed wireless services which can include data, voice and other IP based services.
6. 50% of all non-seasonal, rural households will subscribe to broadband services.
7. With limited available information on the existing fiber in the county, no existing fiber was utilized in the engineering design.
8. Service life for all fiber cable should be 25 to 30 years, but equipment life may be only 8 to 10 years, and may need to be changed out in as few as 5-7 years to provide additional speed that may be required by subscribers.
9. All costs are in 2015 dollars. Inflation mostly affect labor which has been increasing slowly, but Moore's law has equipment costs either trending down or flat with increased speed and features.

The preliminary design was completed on a township basis and included rural areas only.

### **Capital Requirements**

There are two main input parameters that are needed to project the cost to implement a fixed wireless system. The first is the number of square miles by each tower/radio location. This is based on attenuation of the wireless signal due to channel issues such as ground cover and other allowed transmitters. The other input is the number of projected Customers to install. These are also tabulated based on the number of taxable land parcels multiplied by the projected take rate for permanent, year around households. Costs for the fixed wireless network is included Table 4.

# Wireless Model

## Total Homes and Businesses

Total  
Business  
Residential

Take Rate	Rural	Urban	Total
	14178	16769	30,947
50%	414	739	1,153
50%	13764	16030	29,794

Services		Take Rate	Rural	Urban	Total
	Regular		7,091	-	7,091
			7,091	-	7,091

Total Radio Sites	Rural	Urban	Total
	15	0	15

Pre-Design Buildout Estimates	75	Cost/v Miles>	75	0	Total
Mainline OSP Construction		\$ 27,500.00	\$ 2,062,500	\$ -	\$ 2,062,500
Wireless Equipment (located at radio site)		\$ 125,000.00	\$ 1,875,000.00	\$ -	\$ 1,875,000
Towers/Huts		\$ 300,000.00	\$ 4,500,000.00	\$ -	\$ 4,500,000
Costs per Home			\$ -	\$ -	\$ -
	Wireless CPE Equipment	\$ 650.00	\$ 4,609,150.00	\$ -	\$ 4,609,150
	Inside Wiring	\$ 200.00	\$ 1,418,200.00	\$ -	\$ 1,418,200
	Activation	\$ 100.00	\$ 709,100.00	\$ -	\$ 709,100
				-	
Miscellaneous (site prep, permits, etc.)	15%		2,276,093	-	\$ 2,276,093
Engineering	10%		1,745,004	-	\$ 1,745,004
Subtotal			\$ 19,195,047	\$ -	\$ 19,195,047
					\$ 19,195,047

**Table 4: Fixed Wireless Network Capital Requirements**

## Business Model

The proposed business model is basically a plan first for funding and then capital recovery for payment of loans and bonds.

**Funding:** We have assumed that financing for all options in this feasibility study were accomplished via municipal bonds with a term of 15 years and an interest rate of 5%. These financing conditions were chosen for this study because it an option that is available to counties. It is possible and maybe preferable to find other financing options that may have more favorable terms. This would make the construction of the broadband network more feasible.

It was assumed that there would be Connect America Funding (CAF) available in the form of a grant of up to \$875 per potential home served. However, this funding has not been formalized at this point in time and may not be available for all areas or all providers. For this study, it was assumed that 50% of the rural homes and no urban homes qualified for this grant.

RUS Community Connect grant of \$5,000,000 was used in this study for construction of facilities in parts of the county where broadband services are not available. This may take multiple townships or groups applying for this grant in order to achieve this amount. There are a couple caveats to this source of grant funding. Funding for Community Connect Grants is limited and competition for these grants is strong and the criteria that is used to award grants, such household income, may make this grant hard to

receive. The probability of receiving any Community Connect Grant varies from 20% to 60%. The larger the grant applied for reduces the chances of award. Matching funds of 20% is required for the grant.

It was assumed that a Border-to-Border grant of \$5,000,000 was available for construction in this study. The Border-to-Border broadband development grant program offered by the Office of Broadband Development, part of Minnesota Department of Employment and Economic Development (DEED), provides funds for the building out broadband infrastructure and services to areas of Minnesota that are unserved or underserved. Currently, the level of grant funding through this program has been more limited than this level but there is a large amount of interest of greatly increasing the amount of funding available. This grant requires matching funds.

The Rural Utility Service (RUS), an agency within Rural Development under the Department of Agriculture provides various loan and grant programs for rural areas. RUS Broadband or Guaranteed low interest loans often require enough cash contributed by the borrower to fund operations for two years after construction starts when income often falls short of operating expenses not to mention interest payments. Often, a waiver of either one year or two years where principal payments are deferred with just interest payments helps the startup company's cash flow.

Commercial Banks loans may be available, but interest rates are usually higher than can be obtained from RUS although they may be kept low and competitive with an RUS loan guarantee.

A total of \$16.2 million grant funding was assumed in this study from these three sources. Any grant funding not awarded/available would have to be recovered via other financing options, such as the sale of Municipal bonds.

Table 5 shows the Total capital cost and the various sources of funding to meet the capital requirements for the FTTH network. Then the debt retirement is shown in two parts. First the loan debt is figured based on the monthly lease payment per subscriber connected to be paid to Sherburne County for use of the facility collected from broadband subscribers. The monthly payment necessary to pay off the loan is shown with the estimated interest rate (5.00%) and term (15 years) divided by the projected number of customers to yield \$31.80 paid to Sherburne County by the incumbent partner per customer served per month.

FTTH Model - Normal Case				
Summary and Plan for Capital Recovery				
\$	90,295,264	Capital Requirements		
	<u>6,202,875</u>	FCC Potential CAF grant per home passed to expand broadband to rural areas.		
\$	84,092,389	Balance		
	10,000,000	Community Connect and Border-to-Border grants		
	<u>10,000,000</u>	100% of CC and B2B Grants		
\$	64,092,389	Loan		
\$	-			
	<u>(\$506,838.53)</u>	Debt Payment per month	Interest	Months/year
\$	(31.80)	Loan Payment/FTTH Sub/Month	5.00%	12
			Monthly rate	Term - years
			0.417%	15
	<u>(\$106,065.52)</u>	Monthly bond payment	Interest	Months/year
\$	(41.13)	Assessment per year/property	5.00%	12
			Monthly rate	Term - years
			0.417%	10

**Table 5: Total Capital Costs for proposed FTTH Network**



Table 6 shows the Total capital cost and the various sources of funding to meet the capital requirements for the fixed wireless network. In this case, the debt payment per subscriber per month is \$19.18 and the bond assessment is \$4.11/year/property.

Wireless Model - Normal Case			
Summary and Plan for Capital Recovery			
\$	19,195,047	Capital Requirements	
\$	19,195,047	Balance	
	1,000,000	Border-to-Border Grant	
	1,000,000	Border-to-Border Grant Matching Funds	
\$	17,195,047	Loan	
\$	(\$135,977.33)	Debt Payment per month	Interest 5.00% Months/year 12 Monthly rate 0.417% Term - years 15
\$	(19.18)	Loan Payment/Wireless Sub/Month	
\$	(\$10,606.55)	Monthly bond payment	Interest 5.00% Months/year 12 Monthly rate 0.417% Term - years 10
\$	(4.11)	Assessment per year/property	

**Table 6: Total Capital Costs for proposed Fixed Wireless Network**

**Operational Considerations:** It was assumed in this study that construction and operation of fiber facilities would be accomplished through a private partner who would own and operate the fiber network(s). Since Sherburne county was assumed to not own the facilities and would not be the ultimate service provider normal customer service, help desk, operational and maintenance considerations would be provided by the private partner/provider.

It is expected that provision of broadband bandwidth services will be the responsibility of the private partner/provider as well as the construction and provision of FTTH services.

**Debt Retirement and Bonding:** The primary operational considerations would be start-up organizational structure, funding, and partner negotiations. Once the system is built, then processing lease payments to pay off the loans and bonds would be the operational activities performed by Sherburne County.

Any government loan likely will require that Sherburne County maintain a bond covering anyone that handles funds to insure funds are not absconded with and to assure that any loans are repaid.

## Sensitivity Analysis

Sensitivity analysis is very useful when attempting to determine the impact the actual outcome of a particular variable will have if it differs from what was previously assumed. By creating a given set of scenarios, the analyst can determine how changes in one variable(s) will impact the target variable.

Sensitivity analyses were performed for FTTH design. First, sensitivity analysis was completed to determine what affect the construction of only rural areas of the county would have on costs compared to construction of the whole county. It was assumed that all of the CAF, Community Connect and Border-to-Border grants would be utilized for this construction. As seen in Tables 7 and 8, constructing only rural areas reduces overall capital requirements from \$90,295,264 to \$60,517,973. However, this

lowering of capital requirements doesn't equate to a lower Loan Payment per FTTH Sub per month. This is due to the reduction of the number of subscribers from 15,940 to 7,259.

## FTTH Model - Normal Case

### Summary and Plan for Capital Recovery

\$	90,295,264	Capital Requirements					
	6,202,875	FCC Potential CAF grant per home passed to expand broadband to rural areas.					
\$	84,092,389	Balance					
	10,000,000	Community Connect and Border-to-Border grants					
	10,000,000	100% of CC and B2B Grants					
\$	64,092,389	Loan					
\$	-						
	(\$506,838.53)	Debt Payment per month	Interest	Months/year	Monthly rate	Term - years	
\$	(31.80)	Loan Payment/FTTH Sub/Month	5.00%	12	0.417%	15	
	(\$106,065.52)	Monthly bond payment	Interest	Months/year	Monthly rate	Term - years	
\$	(41.13)	Assessment per year/property	5.00%	12	0.417%	10	

**Table 7: Total Capital Costs for County-Wide FTTH Network**

## FTTH Model - Rural Only

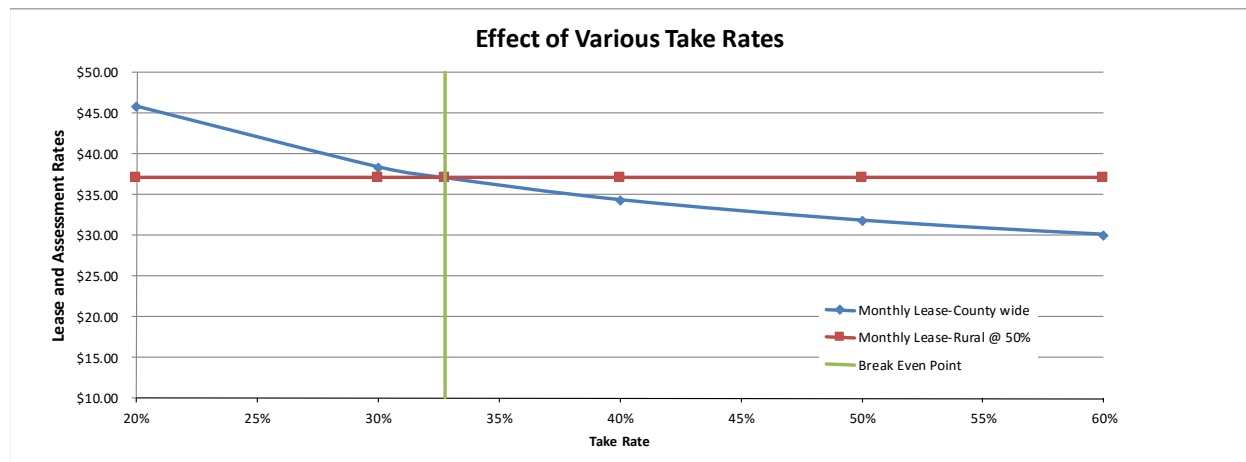
### Summary and Plan for Capital Recovery

\$	60,517,973	Capital Requirements					
	6,202,875	FCC Potential CAF grant per home passed to expand broadband to rural areas.					
\$	54,315,098	Balance					
	10,000,000	Community Connect and Border-to-Border grants					
	10,000,000	100% of CC and B2B Grants					
\$	34,315,098	Loan					
\$	-						
	(\$271,361.60)	Debt Payment per month	Interest	Months/year	Monthly rate	Term - years	
\$	(37.38)	Loan Payment/FTTH Sub/Month	5.00%	12	0.417%	15	
	(\$106,065.52)	Monthly bond payment	Interest	Months/year	Monthly rate	Term - years	
\$	(41.13)	Assessment per year/property	5.00%	12	0.417%	10	

**Table 8: Total Capital Costs for Rural Only FTTH Network**

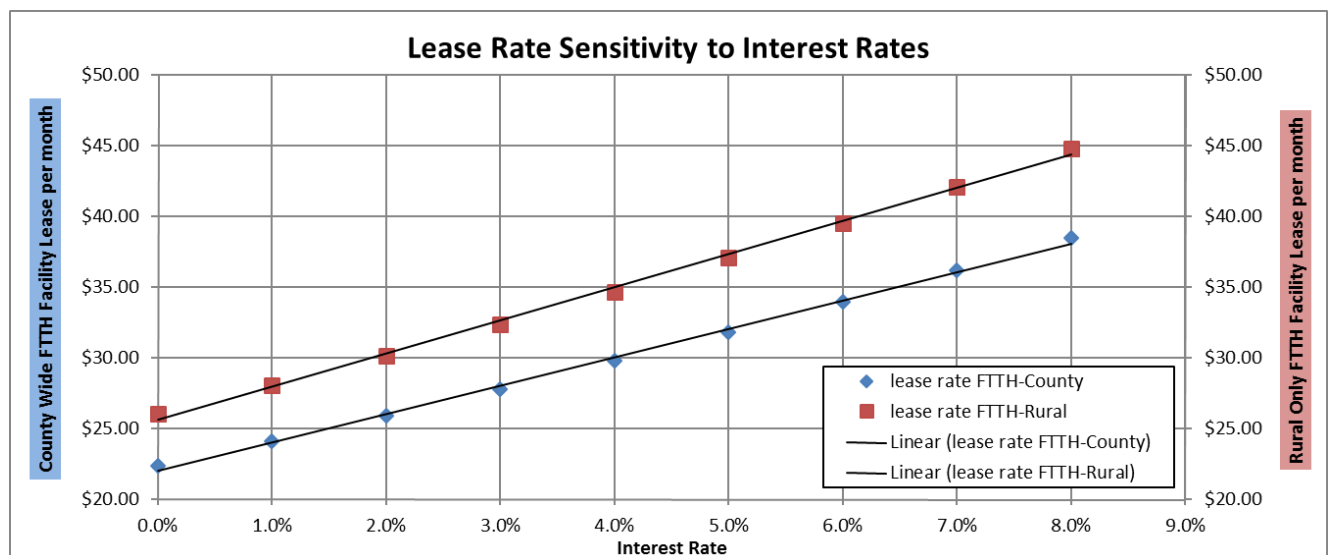
A second sensitivity was performed to determine at what take rate does the rural only option become more feasible when compared to the county wide option. Figure 11 shows the result of this analysis. When the take rate for the county-wide option drops below 32.75%, the rural only option becomes comparatively more feasible.

Effect of Various Percentage Take Rates for FTTH by Property Type										
Take Rate	20%	30%	32.75%	40%	50%	60%	70%	80%	90%	100%
Business+Residential										
30947										
Total Subscribers	6189	9284	10135	12379	15474	18568	21663	24758	27852	30947
Capital Requirements	66,823,210	74,641,755	76,803,147	82,473,803	90,295,264	98,111,432	105,948,235	113,772,612	121,601,745	129,423,206
Capital per subscriber	10,797	8,040	7,578	6,662	5,835	5,284	4,891	4,595	4,366	4,182
Capital per Property	2,159	2,412	2,482	2,665	2,918	3,170	3,424	3,676	3,929	4,182
Monthly Lease-County wide	\$ 45.87	\$ 38.38	\$ 37.04	\$ 34.33	\$ 31.80	\$ 30.06	\$ 28.80	\$ 27.83	\$ 27.08	\$ 26.47
Monthly Lease-Rural @ 50%	\$ 37.04	\$ 37.04	\$ 37.04	\$ 37.04	\$ 37.04	\$ 37.04	\$ 37.04	\$ 37.04	\$ 37.04	\$ 37.04

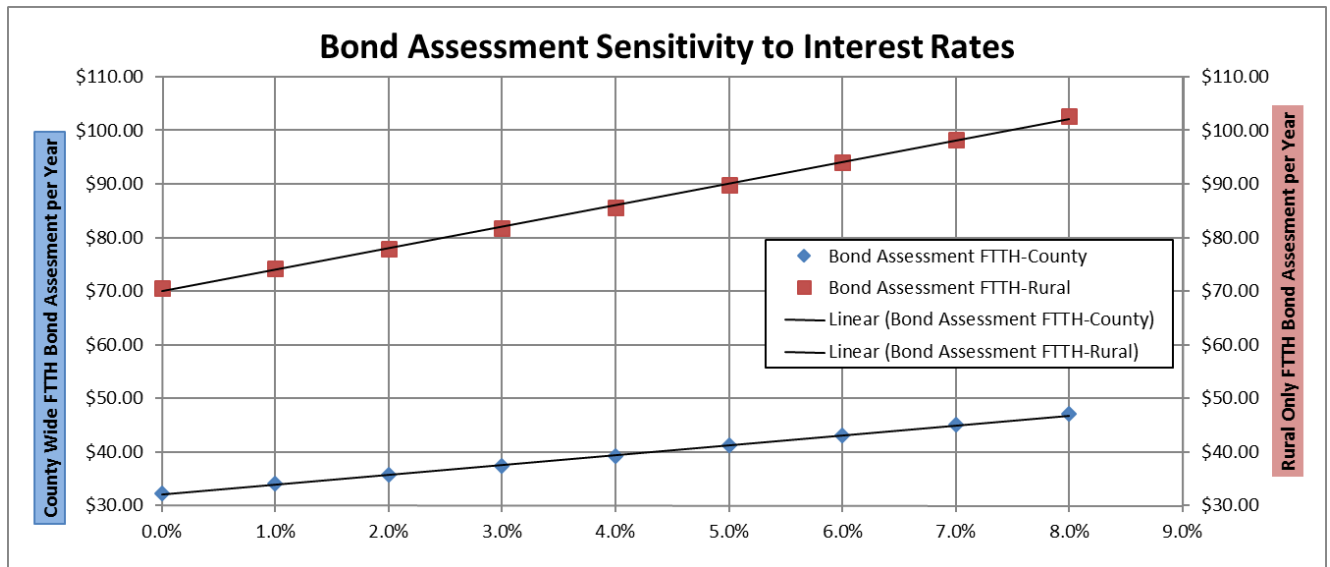


**Figure 11: Break Even Sensitivity Analysis of “Rural Only” and “County-Wide” FTTH Design**

A third sensitivity analysis was performed to demonstrate the effect of changing interest has on the lease rate as well as the annual bond repayment assessment as can be seen in Figures 12 and 13.



**Figure 12: Interest Rate impacts on facility lease payments**



**Figure 13: Interest Rate impacts on Bond Assessment**

The graphs show that increasing interest rates raise both lease rates and bond assessments fairly linearly for both the “County-Wide” and the “Rural Only” FTTH options. Low interest rates available today are an advantage, but interest rates will likely increase in the future.

The next two pages, figures 14 and 15, show sensitivity to various levels of grant funding with various lengths of repayment terms for any loan and for both FTTH options. A shaded blue area on the graph shows what will probably be looked at as favorable lease rates to the private partner.

The final two pages of this section, figures 16 and 17, show the effect of various take rates for both FTTH options. Obviously, the fewer residents that take the service, the more capital cost is needed per actual subscriber.

FTTH Moderate Case Business Model - County	30,947	Households
	14,338	FTTH Subs

#### Summary and Plan for Capital Recovery

\$86,486,770	Capital Cost to construct and turn-up	\$875.00	FCC grant per home passed to expand BB to rural area
6,202,875	FCC broadband funding		
\$80,283,895	Balance		
10,000,000	Community Connect, DEED and other grants		RUS Competitive grant to expand BB to areas without any BB service
10,000,000	Cash for matching funds of grants from Bond Sale		Local debt (special assessment tax levy to recover bonds sold for cash)
\$60,283,895	Loan - RUS or Commercial Bank for remaining funds to reach capital requirement		
\$-			

(\$311,637.00)	Debt Payment per month	Interest Rate	Months/year	Monthly rate	Term (years)
(\$21.74)	Loan Payment/FTTH/Month	5.00%	12	0.417%	15
(\$106,066.00)	Monthly bond payment	Interest Rate	Months/year	Monthly rate	Term (years)
(\$41.13)	Assessment per year/property	5.00%	12	0.417%	10

#### Effect of Various Grant Amounts on Lease Rate and Annual Assessment

Capital Requirement	\$ 86,486,770	\$ 86,486,770	\$ 86,486,770	\$ 86,486,770	\$ 86,486,770	\$ 86,486,770	\$ 86,486,770	\$ 86,486,770
FCC CAF Grant	6,202,875	0	6,202,875	6,202,875	6,202,875	6,202,875	6,202,875	0
RUS Community Connect Grant	10,000,000	10,000,000	8,000,000	6,000,000	4,000,000	2,000,000	0	0
Cash Requirement (20% of CC Grant)	10,000,000	10,000,000	8,000,000	6,000,000	4,000,000	2,000,000	0	0
Loan Amount	60,283,895	66,486,770	64,283,895	68,283,895	72,283,895	76,283,895	80,283,895	86,486,770

Monthly Lease Rate	\$ 21.74	\$ 36.67	\$ 23.94	\$ 26.15	\$ 28.35	\$ 30.56	\$ 32.77	\$ 47.70
Annual Assessment	\$41.13	\$ 41.13	\$ 32.90	\$ 24.68	\$ 16.45	\$ 8.23	\$ -	\$ -

Effects of Various Loan Term Lengths at various Grant Amounts Received on Lease Rates	Term (Years)	FTTH Lease Rates at Total Grant Dollars in top row and Term at left							
	12	\$ 16,202,875	\$ 14,202,875	\$ 12,202,875	\$ 10,202,875	\$ 10,000,000	\$ 8,202,875	\$ 6,202,875	\$ -
	15	38.89	41.47	42.89	44.05	46.63	49.21	51.79	55.79
	18	33.25	35.45	36.67	37.66	39.87	42.07	44.28	47.70
	20	29.56	31.52	32.60	33.48	35.44	37.40	39.37	42.41
	25	27.75	29.59	30.60	31.43	33.27	35.11	36.95	39.81
	30	24.58	26.21	27.11	27.84	29.47	31.10	32.73	35.26

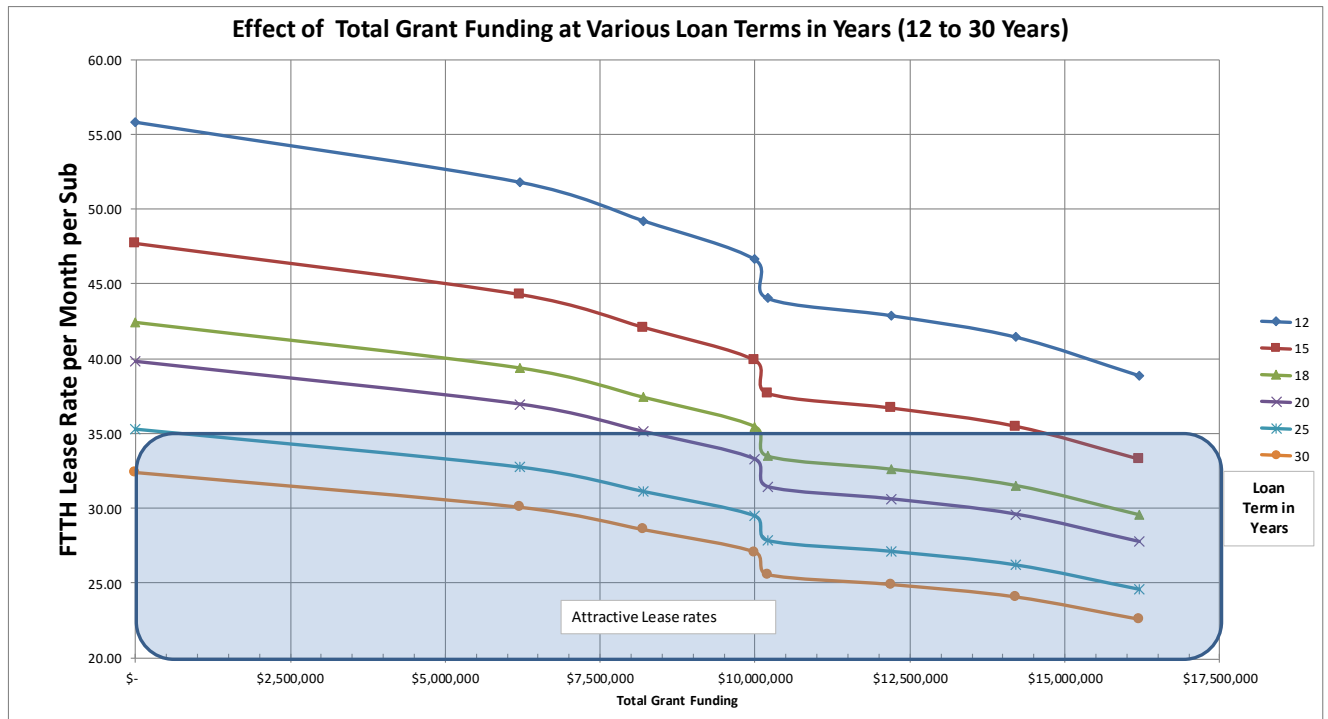


Figure 14: Effect of Total Grant Funding on Various Loan Terms – “County-Wide” Option

FTTH Moderate Case Business Model-Rural Sherburne	14,178	Households
	7,259	FTTH Subs

Summary and Plan for Capital Recovery

\$60,201,723 Capital Cost to construct and turn-up

6,202,875 FCC broadband funding

\$875.00 FCC grant per home passed to expand BB to rural area

\$53,998,848 Balance

10,000,000 Community Connect, DEED and other grants

RUS Competitive grant to expand BB to areas without any BB service

10,000,000 Cash for matching funds of grants from Bond Sale

Local debt (special assessment tax levy to recover bonds sold for cash)

\$33,998,848 Loan - RUS or Commercial Bank for remaining funds to reach capital requirement

\$-

(\$476,071.39) Debt Payment per month	Interest Rate	Months/year	Monthly rate	Term (years)
(\$37.04) Loan Payment/FTTH/Month	5.00%	12	0.417%	15
\$0.00 Monthly bond payment	Interest Rate	Months/year	Monthly rate	Term (years)
(\$89.77) Assessment per year/property	5.00%	12	0.417%	10

### Effect of Various Grant Amounts on Lease Rate and Annual Assessment

Capital Requirement	\$ 60,201,723	\$ 60,201,723	\$ 60,201,723	\$ 60,201,723	\$ 60,201,723	\$ 60,201,723	\$ 60,201,723	\$ 60,201,723
FCC CAF Grant	6,202,875	0	6,202,875	6,202,875	6,202,875	6,202,875	6,202,875	0
RUS Community Connect Grant	10,000,000	10,000,000	8,000,000	6,000,000	4,000,000	2,000,000	0	0
Cash Requirement (20% of CC Grant)	10,000,000	10,000,000	8,000,000	6,000,000	4,000,000	2,000,000	0	0
Loan Amount	33,998,848	40,201,723	37,998,848	41,998,848	45,998,848	49,998,848	53,998,848	60,201,723

Monthly Lease Rate	\$ 37.04	\$ 43.80	\$ 41.40	\$ 45.75	\$ 50.11	\$ 54.47	\$ 58.83	\$ 65.58
Annual Assessment	\$89.77	\$ 89.77	\$ 71.82	\$ 53.86	\$ 35.91	\$ 17.95	\$ -	\$ -

Effects of Various Loan Term Lengths at various Grant Amounts Received on Lease Rates	FTTH Lease Rates at Total Grant Dollars in top row and Term at left								
	Term (Years)	\$ 16,202,875	\$ 14,202,875	\$ 12,202,875	\$ 10,202,875	\$ 10,000,000	\$ 8,202,875	\$ 6,202,875	\$ -
	12	43.32	48.42	51.22	53.51	58.61	63.70	68.80	76.70
	15	37.04	41.40	43.80	45.75	50.11	54.47	58.83	65.58
	18	32.93	36.80	38.94	40.68	44.55	48.42	52.30	58.31
	20	30.91	34.55	36.55	38.18	41.82	45.46	49.09	54.73
	25	27.38	30.60	32.38	33.82	37.04	40.27	43.49	48.48
	30	25.14	28.10	29.73	31.06	34.02	36.98	39.93	44.52

### Effect of Total Grant Funding at Various Loan Terms in Years (12 to 30 Years)

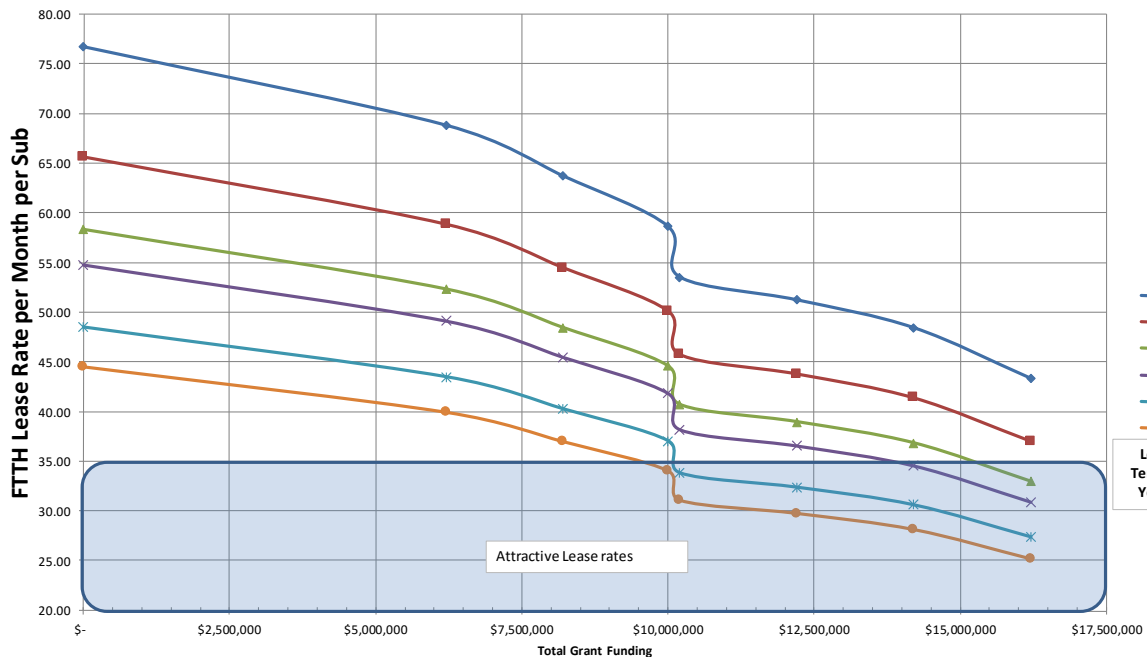


Figure 15: Effect of Total Grant Funding on Various Loan Terms – “Rural-Only” Option

Effect of Various Percentage Take Rates for FTTH by Property Type									
Take Rate	20%	30%	40%	50%	60%	70%	80%	90%	100%
Business+Residential									
30947									
Total Subscribers	6189	9284	12379	15474	18568	21663	24758	27852	30947

Capital Requirements	66,823,210	74,641,755	82,473,803	90,295,264	98,111,432	105,948,235	113,772,612	121,601,745	129,423,206
Capital per subscriber	10,797	8,040	6,662	5,835	5,284	4,891	4,595	4,366	4,182
Capital per Property	2,159	2,412	2,665	2,918	3,170	3,424	3,676	3,929	4,182

Monthly Lease	\$ 45.87	\$ 38.38	\$ 34.33	\$ 31.80	\$ 30.06	\$ 28.80	\$ 27.83	\$ 27.08	\$ 26.47
Annual Assessment	\$ 41.13	\$ 41.13	\$ 41.13	\$ 41.13	\$ 41.13	\$ 41.13	\$ 41.13	\$ 41.13	\$ 41.13

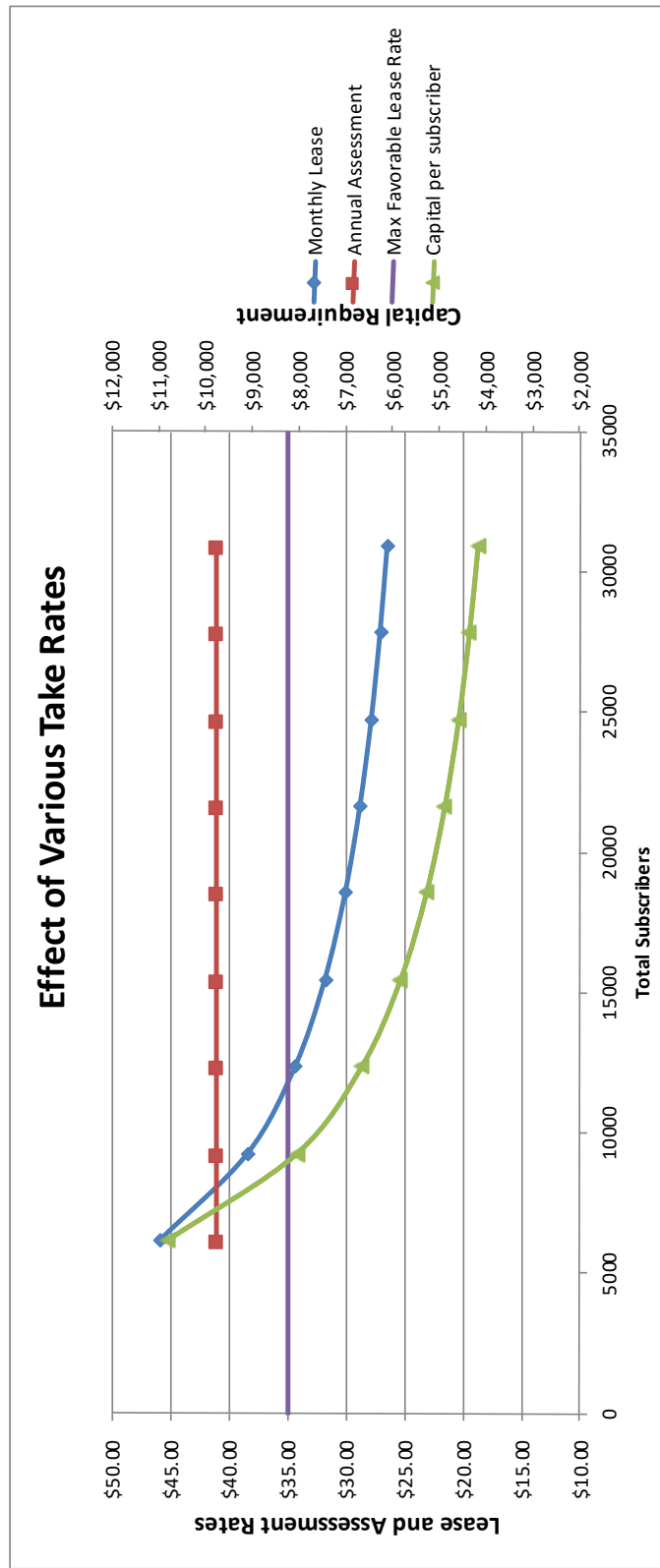


Figure 16: Effect of Various Take Rates – “County-Wide” Option

Effect of Various Percentage Take Rates for FTTH by Property Type									
Take Rate	20%	30%	40%	50%	60%	70%	80%	90%	100%
Business+Residential									
14178									
Total Subscribers	2836	4253	5671	7089	8507	9925	11342	12760	14178

Capital Requirements	48,159,907	52,169,957	56,188,756	60,201,723	64,211,773	68,230,572	72,246,455	76,262,337	80,275,304
Capital per subscriber	16,982	12,267	9,908	8,492	7,548	6,875	6,370	5,977	5,662
Capital per Property	3,397	3,680	3,963	4,246	4,529	4,812	5,096	5,379	5,662

Monthly Lease	\$ 55.47	\$ 45.58	\$ 40.31	\$ 37.04	\$ 34.81	\$ 33.20	\$ 31.97	\$ 31.01	\$ 30.24
Annual Assessment	\$ 89.77	\$ 89.77	\$ 89.77	\$ 89.77	\$ 89.77	\$ 89.77	\$ 89.77	\$ 89.77	\$ 89.77

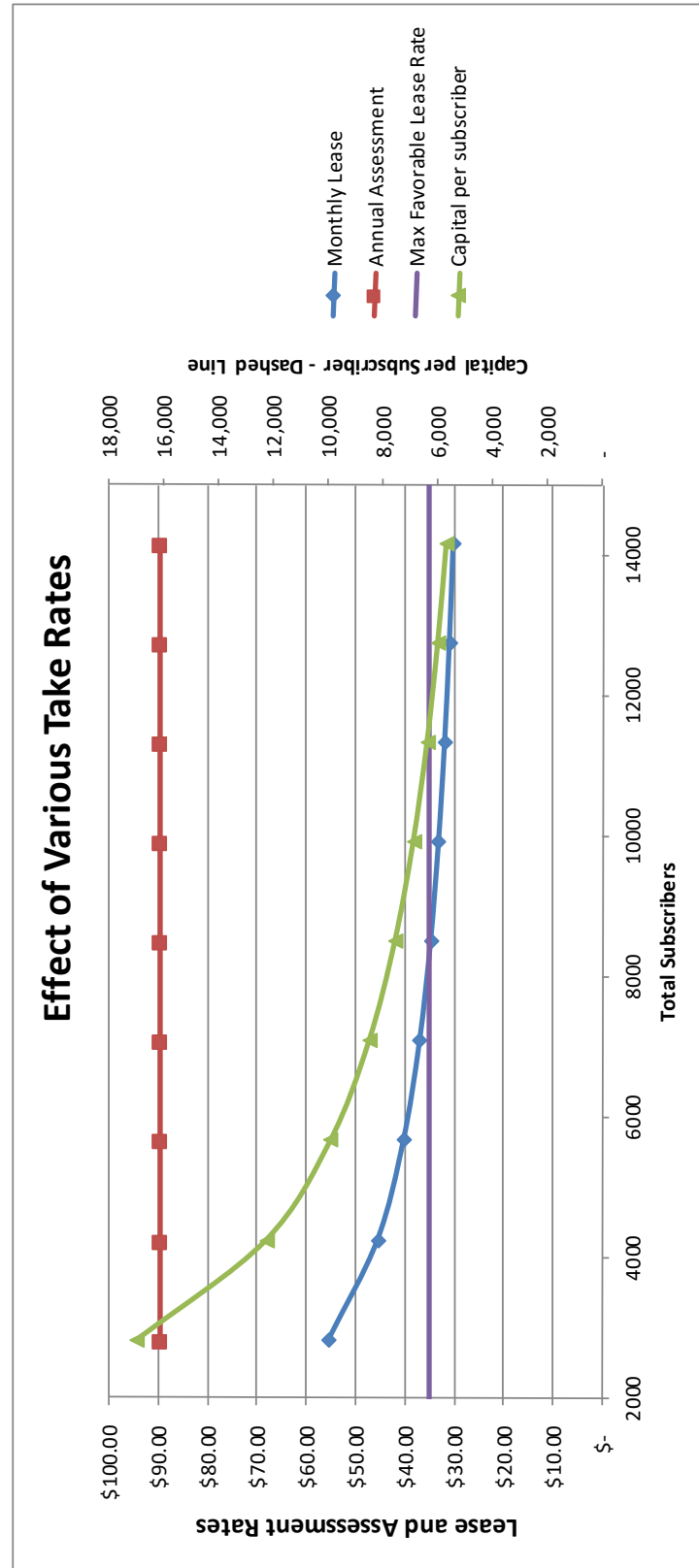


Figure 17: Effect of Various Take Rates – “Rural-Only” Option



## **Conclusions**

It has been the focus of this study to examine the current state of broadband access, options and costs to improve access and possible means of funding these improvements. Sherburne county was interested in broadband access improvements in two areas. First, Sherburne county was interested in connecting government and anchor facilities with access to high-bandwidth, broadband services which allow these entities to leverage advanced services that are not available to them without high-rate broadband access. Secondly, Sherburne county has interest in the advancement of broadband access to residents throughout the county

**Middle-Mile Fiber Network** – The immediate goal of this study has been to analyze the construction of a county-wide high-capacity, middle-mile fiber network. This network is viewed as a starting point to bringing county-wide ubiquitous broadband to Sherburne county and would have multiple purposes. First, this network would be utilized to provide broadband services to the county. It could also be used to provide broadband services to other governmental units such as cities and townships, provide backhaul capacity to public safety wireless systems, connect other anchor facilities such as hospitals, schools and libraries, and provide services to the private sector. Finally, this network could be utilized to provide transport for future FTTH network expansion in the county.

It is proposed that the county partner with a private communications company to implement the fiber network. A private partner would provide operation, administration and maintenance services. The partner will also likely be responsible for construction of the fiber network.

The construction of the fiber network is estimated to cost \$6.93 million to construct. Unfortunately, the grant funding that was available a few years ago through the American Recovery and Reinvestment Act (ARRA) is no longer available. This source of grant funding played a large part in the construction of the Anoka and Carver county networks. Without this funding, Sherburne county will need to tap into other sources of funding. The likely sources for additional funding are the entities who would utilize the network. Cities within the county could help fund the project by the sale of bonds. There may also be future sources of grant funding such as an expanded border-to-border grant program. The partner provider may also provide funding for some of the project.

**Broadband-to-the-Home** – The second aspect of this study has been to identify means of providing broadband services to all of the residents of Sherburne county. The options analyzed in this study were fiber-to-the-home (FTTH) and fixed wireless. From a technology stand point, FTTH is the clear winner. The capacity of a correctly designed all-fiber network is virtually unlimited. Any current constraints on capacity are due to electronics either in the home or in the wire center which can be replaced fairly easily without any upgrades to fiber optic cable in the field. However, this future ready network comes with a fairly high price tag to construct. The capital requirement estimate for a county-wide FTTH network tops \$90 million. Even with \$16 million in grant funding the financed price tag will still be in excess of \$74 million.

Constructing a “rural-only” network assuming that, for the most part, the urban areas have adequate broadband would reduce the capital requirement to \$60.2 million but will reduce the number of homes passed from almost 31,000 to just over 14,000. This reduction in homes passed greatly reduces the income from potential subscribers. The cross-over point where constructing a rural network with an assumed take rate of 50% becomes more feasible than a county-wide network occurs when the urban take rate drops below 32.75%. This scenario may be a likely case and a detailed market survey of urban subscribers would help determine the likely urban and rural take rates.

Finally, a fixed wireless option was estimated. This county-wide network has a capital requirement of \$19.2 million. This network would be more feasible to construct than an FTTH network. Due to topography, trees and interference, a wireless network may not be able to reach all residents without taking extra measures to create a line-of-sight from the tower to the home or mitigating the source of interference. Also, a wireless network doesn't have the capacity and isn't as future ready as an FTTH network. The advantages of a wireless broadband network are that it can be constructed without having to make a large investment in placing fiber-optic cables passed all homes. Also, it is relatively easy to re-purpose customer equipment as needed. If one subscriber cancels service, the electronic equipment can be utilized elsewhere. Finally, broadband services can be turned up to any home without the need to construct physical network elements.

A wireless broadband network would complement the construction of a FTTH network as it would accelerate the ability to turn up new customers. As areas of the county increase in penetration of broadband services, FTTH facilities may become economic to construct to that area. At that time the wireless equipment could then be re-used in other areas of the county.

In order to better understand which direction the county should pursue. It would be advisable for the county to have a detailed market survey performed to gain a better understanding of the view of the residents based on statistical techniques that will help to quantify the desire/need of broadband services as well as the price points at which residents are comfortable paying for broadband services.

## **Next Steps**

- 1) Continue engaging, local, state, and national politicians and their staff. These people will be helpful and likely necessary in gaining support for any non-traditional track to implementing broadband in Sherburne County.
- 2) Surveys – A more in-depth Survey with statistical sampling will be helpful in quantifying the strength of desire for advanced broadband services in Sherburne county including the levels of financial support residents and businesses would be comfortable with.
- 3) Power of the People – Engage the residents of Sherburne County to leverage their strength as a group by communicating with their current providers as well as their representatives in local, state and federal government. Hopefully, there will be a core group who is very dedicated to increasing the access to broadband services in Sherburne County. This group will be very necessary in the success of improving county-wide broadband services.
- 4) Engaging the Blandin Foundation, League of Minnesota Cities, Association of Counties or other organizations that may be useful in determining the best path to choose and in any organizational changes required for Sherburne County to legally enter into agreements with RUS and partners.
- 5) Continue meeting with existing providers and potential provider partners. There may be ways for the county to foster the availability of broadband services that are unknown at this time. Meeting with providers may help in understanding issues and foster relations with possible partners.
- 6) Keep it up – The feasibility study is only the first step in a lengthy and sometimes difficult process. Dedication by the people of Sherburne County and their representatives will be necessary to make projects like these happen.

Compass Consultants is pleased to have been able to work with the Sherburne County to prepare this report, and stands ready to assist the County with any future negotiations with potential partners, loan or grant applications, or any additional design considerations.