Le Sueur County, Minnesota

Broadband Feasibility Study

March 15, 2019

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EXECUTIVE SUMMARY

Finley Engineering and CCG Consulting submit this report of our findings and recommendations for building fiber in the rural parts of Le Sueur County. The county is typical of many rural counties in Minnesota where the towns and cities today have decent broadband and where some rural parts of the county have or will soon have fiber to residents. In the case of Le Sueur County, the vast majority of the geographic area of the county will not be getting fast broadband.

Some rural parts of the county today are served by ISPs offering fixed wireless broadband, and it's likely that this technology will improve some over time. However, not all rural residents have access to good wireless broadband, and even where there is fixed wireless it's not as fast and robust as broadband over fiber.

The county believes that fixed wireless broadband is not a permanent broadband solution and you would like to eventually have fiber everywhere. Industry trends show that the amount of bandwidth needed by a typical home will keep growing, and that within a decade the wireless technology will feel too slow for customers and become obsolete in the same manner that happened in the past with dial-up and DSL broadband.

Our analysis shows that it is economically possible to build fiber everywhere in the rural parts of the county but it will be a challenge. Any fiber business plan is going to need significant grant funding and a relatively high customer penetration rate. The county's big challenge will be finding an ISP partner willing to tackle the fiber business plan.

This report consists of several sections. Included is analysis of the current landscape of service providers in the county and the prices they charge today for broadband and other products. Next is a summary of the engineering analysis performed by Finley Engineering that estimates the cost of constructing the fiber and adding the electronics needed to provide fiber broadband.

Following is a description of the financial analysis done for the study that examined the financial impact of implementing various business plans and scenarios. The goal of these studies was to understand the financial dynamics of the market and to understand the impact of changing the key variables - in total we examined 32 financial scenarios in order to understand the nuances of finding a broadband solution.

The report also discusses some topics related to providing fiber broadband. There is a section discussing the consequences for the county from not having adequate broadband. The report also looks deeper at the technology used to deliver fiber broadband and compares it to some of the other competing technologies used in the county today. The report also looks in more detail at funding options and opportunities.

FINDINGS

Following are the key findings of our investigation:

BASIC FACTS ABOUT THE COUNTY

The Study Area: The study area consists of those areas of the county that don't have broadband today that meets the state's goal of 100 Mbps download speeds. Perhaps the easiest way to understand the study area is to look at a map of the areas that already have broadband. The study area includes some of the areas served by CenturyLink, Frontier Communications, Consolidated Communications, and Bevcomm. This map is included in Exhibit I. As can be seen, most of the geographic area of the county is included in the study.

Excluded from the study are:

- Areas that already have fiber and that are served by Lonsdale Telephone Company and Bevcomm in the northeast corner of the county.
- All towns except the small towns of Cordova, Kilkenny, and Ottowa.
- Fiber that has been built by Jaguar Communications along some highways in the county and that serves fiber to those living only along those highways.

We studied four scenarios, representing different subsets of the study area:

- We first studied the unserved areas where households don't have access to broadband of speeds of at least 25/3 Mbps download speeds. That speed has been adopted by the Federal Communications Commission as the definition of broadband. We looked at these unserved areas in two ways – with and without the rural areas served today by Bevcomm. There is a chance that the company will build fiber to all of the households in their service area.
- We then studied the whole study area as shown in Exhibit II. That exhibit is showing the areas that were excluded from the study in purple. The study area includes all households that don't have access today to broadband speeds of at least 100/20 Mbps, which is the broadband speed goal for the state of Minnesota.

Potential Customers: We used several different sources of data for counting homes and businesses in the study areas. The primary source of information was county GIS data. Most of the businesses in the county are in towns that have broadband today and we counted the remaining businesses using Google Maps. The county provided a count of businesses in the study area. The number of passings (potential homes and businesses) used for the rural study areas is as follows:

Unserved Areas excluding Bevcomm	2,402
Unserved Areas including Bevcomm	2,539
Areas without 100/2 Mbps excluding Bevcomm	2,954
Areas without 100/2 Mbps including Bevcomm	3,233

Road Miles: There are a lot of miles of fiber required for each of the scenarios. The detail of the route miles of fiber is as follows:

Ring (for every scenario)	74.6 miles
Unserved Areas excluding Bevcomm	537.8 miles
Unserved Areas including Bevcomm	559.8 miles
Areas without 100/2 Mbps excluding Bevcomm	582.3 miles
Areas without 100/2 Mbps including Bevcomm	615.8 miles

ENGINEERING FINDINGS

Backbone Fiber Network: The proposed network design includes the construction of a fiber ring that provides a connection between the various network huts. This fiber ring would be self-healing, meaning that it could continue functioning with a fiber cut. The recommended backbone fiber in the analysis is 74.6 miles long and built with 96 fibers to accommodate future growth.

Aerial vs Buried Fiber: The entire network was designed using buried fiber. The soil in the county allows for relatively easy burying of fiber and the cost to bury fiber in the rural parts of the county would not be any higher than to place the fiber onto existing poles. A buried network will last longer and have fewer maintenance issues.

Total Asset Costs: Following are the assets required to launch the fiber network. These assets are needed to support a 70% customer penetration rate. The amount of assets needed will vary with a higher or lower number of customers.

	Unserved W/O Bevcomm	Unserved W/ Bevcomm
Fiber & Drops	$14,542,391	$15,147,440
Electronics	$ 1,477,747	$ 1,620,832
Huts/Land	$ 343,396	$ 429,245
Operational Assets	$ 212,670	$ 213,160
Total	$16,576,204	$17,420,677

	Whole Area W/O Bevcomm	Whole Area W/ Bevcomm
Fiber & Drops	$15,544,427	$16,590,870
Electronics	$ 1,749,797	$ 1,946,447
Huts/Land	$ 343,396	$ 429,245
Operational Assets	$ 214,625	$ 215,635
Total	$17,852,245	$19,182,197

BUSINESS PLAN RESULTS

The financial summaries of the various business plans are described in Section III.B of this report. There is also a summary of all financial results in Exhibit IV.

It is going to be financially challenging to build fiber in all of the rural parts of the county – but not impossible. It's clear that it's going to require grants to make fiber viable. That could mean grants from the Minnesota Border-to-Border grant program or from federal grant programs. But it's also likely to require some grants from the county.

The primary reason that a fiber business is so challenging is that the rural parts of the county are sparsely populated. In many other counties we've studied in Minnesota there are small towns without broadband, which reduces the construction cost on a per customer basis. In your county the towns and cities already have broadband.

There are a few other key financial findings:

- The fiber business in general is an economy-of-scale business, meaning that profitability increases with more customers. It looks more viable to build fiber to the whole rural area instead of just parts of it.
- The business plan is sensitive to a few key variables. Following are the key variables and their impact:
  - Penetration Rate. Increasing customers from 70% to 80% generates an additional $3.54 million over 20 years.
  - Broadband Prices. Increasing Residential and Business Broadband rates by $5 per month increases cash over 20 years by $2.28 million.
  - Interest Rate. Changing the interest rate by one-half of a percent (50 basis points) changes the cash over 20 years by $1.11 million.
  - Lower Network Cost. Shaving $1 million from the cost of construction improves cash over 20 years by $1.46 million.
  - $1 Million Grant. Receiving a $1 million grant to help pay for the project increase cash flow over 20 years by $1.39 million.
- It looks like municipal bond financing for the rural areas would be a challenge. This is probably not going to be an issue since the county doesn't want to be the ISP and own the network. But this would eliminate the options for a public-private partnership where the county owns the network and somebody else operates it.
- It looks like any commercial ISP that finances the network will need to contribute significant equity, between $3 million and $4 million. That could be a limiting factor for many small ISPs that might consider the opportunity.

RECOMMENDED NEXT STEPS

We recommend the following next steps after this study.

1. **Consider a Residential Survey**. Probably the key factor that will make the opportunity attractive to an ISP is the number of residential customers in the rural parts of the county that would consider switching service to a fiber network. ISPs understand that demand varies by market and we've seen rural markets where 60% of customers are interested in better broadband and others where more than 90% are interested. The financial analysis shows that this business plan is likely to take a customer penetration rate higher than 70%, and so we recommend that you undertake a survey to understand the demand in Le Sueur County.

   You are also going to have to keep an eye on customer demand over time. At some point in the future Midco will be bringing faster radios to the county than those used by the WISPs today, plus the current WISPs might upgrade their electronics. While it's clear that fiber is the superior bandwidth network over the long haul, many customers might be satisfied with speeds of 50 Mbps to 100 Mbps on wireless, making it a challenge to reach the needed customers to pay for the network. This study contemplates that the pricing on fiber will be lower than what the wireless providers charge today, but that doesn't mean that they won't get price competitive to keep customers on their network.

2. **Consider the Possibility of Providing Some County Funding**. The financial analysis shows that it's likely that the county is going to have to offer some grant funding to an ISP to make this work. Even if an ISP got a full $5 million Border-to-Border grant the financial opportunity might still not be good enough to attract a partner. It's also easier to get a larger Minnesota Border-to-Border grant if there is additional local funding for the project. There are probably a dozen counties in Minnesota that have now pledged to make local grants – ranging from $250,000 to $6 million. Your county is literally competing with the other counties in the state to get funding.

3. **Find a Partner(s)**. There are several potential partners already operating in or near to the county that might be interested in tackling some or all of the identified study areas. We suggest meeting with them, showing them the results of this study, and possibly expanding the search for partners if none of the obvious candidates show an interest.

4. **Be Prepared to Provide Assistance to Service Providers.** Any state or federal grant program requires a showing of customer and community support. The county should be prepared to help a partner by seeking customer support for the grants. The county could go even further – for example we've seen counties where there has been a local pledge drive to seek signatures from interested citizens.

5. **Educate and Motivate the Public**. We've seen that a motivated and vocal public can help to convince service providers to bring broadband and can also help to keep the pressure on politicians to maintain the grant programs. The county should continue to support a broadband task force that investigates fiber. You also might consider creating resources for broadband such as a county web site that would be used to educate the public, answer questions, and provide links to fiber-related resources.

6. **Be Persistent.** A lot of counties in Minnesota are looking for a broadband solution. It's not likely that you'll make a round of meetings to the service providers and have a solution. This might take many years, and perhaps settling for building pockets of the county over time to get this done – depending upon the interest and financial capability of the partner ISP.

I. BACKGROUND RESEARCH

In this section of the report, CCG will look at the incumbent providers in the county, at the products and prices of existing service providers in the market, and at the impact of the Connect America Fund. Like many counties in Minnesota, the county is served by a number of incumbent providers with separate core service territories.

A. Current Broadband Providers and Prices

The county has numerous ISPs offering broadband today. This includes incumbent cable and telephone companies and several wireless ISPs. Historic telephone service in the county was provided by a number of different incumbent providers. The two big telephone providers are CenturyLink and Frontier, which together serve roughly 80% of the geographic area of the county. There are also smaller telcos. Bevcomm and Lonsdale Telephone company already provide fiber optic networks in the northeast corner of the county. Consolidate Communications now provides service in the southwest corner of the county.

There are two incumbent cable operators operating in many of the towns in the county. Comcast, the largest cable company in the country, serves New Prague. Mediacom, a company that serves a lot of smaller communities in Minnesota, operates in Le Sueur, Kasota, Montgomery, Elysian, and Waterville.

Finally, you have an unusual situation where Jaguar Communications serves fiber to customers living near to several highways in the county. When Jaguar built fiber through the county they elected to also serve those close to those fiber routes. However, households out of reach of the Jaguar fiber largely have no fast landline broadband options.

This section of the report examines the broadband prices available to customers today in the county. It used to be easy to analyze the prices of services. Just a few years ago you could go to the web and find the prices charged by any telco or cable provider, and except for the rare special, most customers in a given town paid about the same thing for service. This is no longer true. Most telco providers have removed their “standard” prices from the web and so there is often no baseline cost you can compare. Further, companies have developed strategies to charge different rates to different customers.

We know from experience that prices will vary widely by customer. Over the years, customers have purchased bundles or participated in promotional pricing and might be charged differently than their neighbors. It seems almost counterintuitive, but the customers paying the most from most incumbents are often those that have been with them the longest. This means that there is no longer anything that can be considered as a “standard” price in the market. Nevertheless, if want to examine the economic viability of bring fiber to the rural parts of the county it’s important to understand the prices being charged for broadband. As you will see from our analysis, there is already a price disparity between the rural parts of the county and the towns, with broadband in the rural areas mostly being more expensive.

At the end of this section we are also going to try to the answer the question of how broadband rates are likely to change looking into the future.

Incumbent Telcos

A map showing the service areas of the incumbent telephone companies is included as Exhibit I.

CenturyLink is the third largest telephone company in the country with headquarters in Monroe, Louisiana. Several years ago, the company purchased Qwest, which was formerly Mountain Bell and US West, and was part of the Bell Telephone system. The company provides service in the western third of the county in the St. Peter and Le Sueur exchanges. At the end of the third quarter of 2018 the company had 5.4 million broadband customers. The company has a small number of cable customers but has announced that it is phasing out that business line. For most of the areas it covers the company bundles with DirecTV.

As the incumbent provider, CenturyLink is considered the "provider of last resort" in its service areas. This means that CenturyLink is required to serve all residential and business customers for basic local services, and it must provide facilities to all customers. The rules that govern the way that CenturyLink serves customers in the county are embodied in their "General Customer Services Tariff," which is approved by the Minnesota Public Utilities Commission. This tariff contains all of the regulated products and prices, along with the terms and conditions under which CenturyLink will sell them to customers. The tariff sets forth rules for such customer service procedures as the manner and amount of customer deposits, the rules by which they will disconnect service for nonpayment, and the rules by which they will reconnect service. We'd like to note here that a recent trend is to get states to deregulate many services as competitive and take them out of the tariff; the Minnesota tariff has had many products removed in recent years.

In recent years CenturyLink invested significant capital in improving data speeds in metropolitan areas. For example, in 2016 the company built fiber to pass 900,000 homes in major markets like Seattle, Phoenix, Denver, and the Twin Cities. Since then the company has merged with Level 3 Communications and last year the new CEO announced that the company would not be making any future investment in assets with "infrastructure returns," meaning it's not going to build new fiber to residential customers and is probably not going to invest any more money in its copper networks.

CenturyLink accepted $3.5 million, paid over six years, from the Connect America Fund (CAF II) to enhance the DSL in rural parts of Le Sueur County. That money is supposed to be bringing at least 10/1 Mbps to 938 rural homes.

Telephone Rates

CenturyLink's telephone rates were as follows when last tariffed. This does not mean that these are the rates any longer and with a de-tariffed rate CenturyLink is allowed to charge whatever they want, within reason. The following rates were the last listing of the flat rate option, meaning a telephone line using these rates can make unlimited local calls. There used to be options available for customers who wanted to be able to make and pay for fewer local calls.

	Monthly
Flat Rate Residential Phone Line	$18 - $22
Flat Rate Business Telephone Line	$42 - $45
Business PBX Trunk Lines	$45 - $51

These rates do not include the Subscriber Line Charge which is currently $6.50 for both a business and a residential line and would be added to the above rates. The rates also do not include the Access Recovery Fee (ARC), which is an FCC fee that is currently capped at $1 per month, and CenturyLink could be charging any amount up to and including the $1 rate.

CenturyLink telephone line prices don't include any features. These features are either sold a la carte or sold in bundles and packages. Some of the most commonly purchased features are call waiting, 3-way calling, voice mail, and caller ID. CenturyLink offers dozens of features and they range in price from $2.95 to $8.50 per feature for residential service. These products are also now de-tariffed and CenturyLink can charge whatever it likes for these products.

CenturyLink DSL

CenturyLink sells high speed Internet using DSL technology. They sell both a bundled DSL product, meaning that you purchase it along with a telephone line, and also a "Pure" product, meaning a customer can buy just DSL (most of the industry refers to this as naked DSL). As discussed above, CenturyLink offers a lot of specials, with special rates available on their web site for new customers. But as typical with most big ISPs, a subscriber's rates will revert to "normal" rates at the end of a special promotion. Following are base list prices for residential DSL. Note that the quoted speeds offered by CenturyLink DSL are "best effort" speeds, meaning they are not guaranteed. In fact, rural customers typically get speeds significantly slower than the advertised speeds.

Residential DSL

Pure DSL is CenturyLink's name for a DSL line that is not bundled with telephone or DirecTV. There is one price for the first year, a higher price for the second year, and after that the customer pays the list price:

	1st Year	2nd Year	List
1.5 Mbps download, 896 Kbps upload	$30.00	$40.00	$42.00
7 Mbps download, 896 Kbps upload	$35.00	$45.00	$47.00
12 Mbps download, 896 Kbps upload	$40.00	$50.00	$52.00
20 Mbps download, 896 Kbps upload	$50.00	$60.00	$62.00
40 Mbps download, 896 Kbps upload	$60.00	$70.00	$72.00

Pure DSL also requires a DSL modem. The charge for this seems to be negotiated and ranges from $1.95 to $6.95.

We don't expect that there is any DSL in the county faster than 12 Mbps. Generally, the faster speeds are available only in the metropolitan markets.

CenturyLink Business DSL

CenturyLink no longer publishes business DSL prices. There are no prices on the website and no prices listed in any of their sales literature or tariffs. Basically, CenturyLink will negotiate a price with a business customer based upon how many other products they purchase and also depending upon how long they are willing to sign a contract.

When CenturyLink last published rates their slowest business DSL ranged from $40.00 per month for a 3-year contract up to $62.50 for a month-to-month product and no contract commitment. But today each customer will negotiate with a salesperson and rates charged in the market are all over the board for the same product.

Frontier Communications is the fifth largest telephone company in the US. The company changed their name from Citizens Communications Company in 2008. Frontier Communications has grown through acquisitions. For instance, in 2015 they agreed to buy 2.2 million customers from Verizon in Florida, Texas, and California. The company spent $8.5 billion to buy a huge pile of customers from Verizon in 2009 and in 2013 bought the Connecticut operations of Verizon. As of the end of the third quarter of 2018 the company had 3.8 million broadband customers and 873,000 cable customers. The company serves most of the western half of the county including the Belle Plains, Le Center, Montgomery, Kilkenny, Waterville, and Elysian exchanges.

Frontier is an incumbent telephone provider and is considered a provider of last resort, meaning they must try to reasonably provide telephone service to somebody within their defined service area.

Frontier also accepted money from the Connect America Fund to enhance DSL speeds in the county and took $5.54 million in Le Sueur County, paid over six years, to improve broadband speeds to at least 10/1 Mbps for 1,748 rural homes.

Frontier's telephone rates are still tariffed. However, the company is allowed to charge less than the tariffed rates with bundling with other products or promotional specials.

Frontier offers cable TV in rural areas through bundles with Dish Network.

Telephone Rates

Telephone rates in the county vary today by community. Here are the latest tariffed rates[1]:

[1] The Frontier tariff can be found at: http://carrier.frontiercorp.com/crtf/tariffs/index.cfm?fuseaction=local&stateID=MN&sctnID=6&companyID=103

	Residential	1-Party Business	Key Line	Trunk
Belle Plaine	$13.10	$33.68	$37.77	$49.04
Elysian	$15.09	$31.71	$35.00	$40.30
Kilkenny	$15.15	$33.61	$38.39	$44.33
Le Center	$18.25	$36.41	$40.72	$47.92
Montgomery	$19.27	$49.17	$53.59	$64.78
Waterville	$13.56	$26.08	$28.46	$34.55

All of these products have an extra charge of $6.50 for a Subscriber Line Charge and up to $1 for an Access Recovery Charge (ARC).

The company also offers a residential phone line with unlimited long distance. This is not a tariffed product. The current web special has a price for $34.99. Over time this will increase to some higher number. We've seen bills of customers paying $40.99, plus the fees.

Frontier DSL. In your area all Frontier broadband is with DSL served on copper lines. The company has three DSL products available nationwide:

6/1 Mbps	Simply Broadband Core
12/1 Mbps	Simply Broadband Ultra
18/1.5 Mbps	Simply Broadband Plus

These are "up-to" speeds and we know that many rural customers get significantly slower speeds, with some reports barely faster than dial-up. As mentioned elsewhere in this report, the company has taken money from the FCC to supposedly upgrade many of the rural DSL customers in the county to speeds of at least 10/1 Mbps.

Frontier doesn't disclose the list price of these products. New customers get promotional prices with the disclaimer that after two years the prices will revert to the "list price at that time." All products also get assessed a $1.99 Internet Infrastructure Surcharge. This is not a tax and is part of the price of the product.

Consolidated Communications is a large incumbent telephone company headquartered in Mattoon, Illinois. Consolidated purchased Enventis Corporation in 2014 which included the telephone properties known as Hickory Tech. That purchase included two local telcos that operate in the southwest corner of the county that were previously known as Mankato Citizens Telephone and Mid-Communications.

Consolidated has grown rapidly through acquisitions and tripled the size of the company in 2017 with the purchase of FairPoint Communications in New England. The company now has over 670,000 customers and operates in 23 states. The company trades on NASDAQ under ticker symbol CNSL

DSL Broadband

6 Mbps / 768 Kbps	$60.70
10 Mbp / 768 Kbps	$70.70
20 Mbps / 2 Mbps	$75.70
WiFi Modem	$ 8.00
Kaspersky Internet Security	$2.99 to $4.99 per month

Also sells DirecTV Now and Fubo TV – online cable programming

The broadband products have no data caps.

Residential Telephone

Voice Plus	$24.99	60 minutes LD, Caller ID, Call Waiting
Voice Value	$29.99	60 minutes LD and many features
Voice Unlimited	$35.99	All features and unlimited LD

There are $6+ of fees added to these rates that are revenue to the company (not taxes)

Cable TV. The company sells cable TV, but this is in Mankato and may not be available in the rural parts of their area included in the county.

Basic	$26.74
Standard	$29.95
Select	$77.49
Expanded	$83.49

The company offers a $10 bundling discount for combining cable or phone with broadband.

Security

The company sells and installs SimpliSafe home security systems

Bevcomm, formerly known as the Eckles Telephone Company, is a fourth-generation family-owned telephone company that was founded by the Eckles family in 1895. The company has headquarters in Blue Earth, MN. In the county the company serves the northeast corner of the county with the New Prague exchange.

The company is in the process of building fiber everywhere.

Residential Broadband Prices

DSL

Low Income 4 Mbps	$9.95
4 Mbps	$49.95
8 Mbps	$59.95
15 Mbps	$69.95
25 Mbps	$79.95

Fiber	
30 Mbps	$49.94
60 Mbps	$59.95
90 Mbps	$69.95
1 Gbps	$149.95
WiFi	$4.95
Antivirus, etc.	$3.95
Wire Maintenance	$4.00

Telephone

City Phone	$30.28
Rural Phone	$35.28
Business Phone	$46.37

These prices include fees and key features

Long Distance 10.9 to 12.9 cents per minute, bundles of minutes available

Cable TV

Basic TV	$48.95
Bevcomm TV	$94.95

Price includes 2 settop boxes

DVR	$10.95
HDTV	$9.95

There are numerous bundles available.

Lonsdale Telephone Company serves a small part of the county in the northeast corridor. This is a family telephone company founded in 1936. The company has built fiber in the service territory.[2]

Broadband Prices

8 Mbps	$35.95
12 Mbps	$42.95
15 Mbps	$49.95
30 Mbps	$59.95
50 Mbps	$69.95
100 Mbps	$87.95
1 Gbps	$129.95

[2] Here is an article on the company's history:
http://www.southernminn.com/lonsdale_area_news_review/news/article_14201e38-090c-5f4c-a676-51a3dcf9a804.html

Telephone

Residential Phone	$29.90
Measured Phone	$20.10 plus $0.10 per minute for all calling
Features are extra	

IPTV

Basic	$26.95
Expanded Basic	$69.95
Digital	$78.95
Numerous bundles are available	

Jaguar Communications is an overbuilder that serves a few customers in the county. The company got a Minnesota border-to-border grant a few years ago and used the money to extend fiber through the county. In the rural areas they serve customers that live directly adjacent to their fiber routes. They compete for business customers in a few of the cities.

Their list price for residential broadband on fiber is:

75/75 Mbps	$69.95
100/100 Mbps	$79.95
125/125 Mbps	$89.95
WiFi Modem	$ 5.00

Cable TV Providers

Comcast is the incumbent cable TV provider in New Prague. They market and bill services to customers using the "Xfinity" brand name. They are the largest cable TV company in the US with 2017 revenues of nearly $85 billion, and the second biggest cable company in the world. They are headquartered in Philadelphia. At the end of the third quarter of 2018 the company had 26.9 million broadband customers and 22 million cable customers.

In addition to being a triple-play provider, the company owns a number of media assets like NBC, Telemundo, MSNBC, CNBC, USA Network, The Golf Channel, Syfy, numerous regional sports networks, Universal Pictures (and theme parks), DreamWorks, and the Philadelphia Flyers hockey team and arena. The company now sells cellular phone service. They are probably the largest seller of smart home services.

The company offers the traditional triple play of cable TV, internet, and voice services.

Stand-Alone Internet

Performance Starter	$49.95
Performance	$69.95
Blast!	$79.95
Extreme	$89.95
Gigabit	$139.95
Modem	$13.00

All Internet products have a 1 terabyte data cap.

Telephone

Basic	$20.00
Unlimited	$44.95

Cable TV

Digital Economy	$39.95
Digital Starter	$69.95
Digital Preferred	$87.90
Settop box	$10.45

The following fees are charged to every cable package:

Broadcast TV Fee	$10.00
Regional Sports Fee	$8.25

The company offers numerous bundles.

Mediacom is the incumbent cable TV provider in Montgomery, Le Sueur, Elysian, Waterville, and Kasota. They are a large cable company with corporate headquarters in New York City. They are an interesting company that serves some large markets like parts of the New York City metropolitan area but mostly serves numerous small rural markets. At the end of the third quarter of 2018 the company had 1.26 million broadband customers and 793,000 cable customers. They offer the triple play products either standalone or in bundles.

Telephone Rates. Mediacom offers a phone line with unlimited long distance calling and 17 features.

Standalone Phone	$49.95
Bundled with one other product	$39.95
Bundled with TV and broadband	$29.95
Voicemail	$ 4.95

Residential Broadband

60/5 Mbps	$69.99	400 GB cap
100/10 Mbps	$79.99	1 TB cap
200/20 Mbps	$99.99	2 TB cap
500/30 Mbps	$119.99	4 TB cap
1 Gb / 50 Mbps	$139.99	6 TB cap
Modem $10		

All broadband products also require the lease of a cable modem for $7.50/month.

Cable TV

Basic	$29.95
Family TV	$72.95
Prime TV	$88.95
Local Surcharge	Varies by market, up to $8.
Regional Sports Surcharge	Up to $3

Bundles

Local 60 Double Play $110.44
60 Mbps / Local Plus TV

Silver 60 $169.98
60 Mbps / Family TV / Unlimited phone

Xtream Silver 100 $179.98
100 Mbps / Family TV / Unlimited phone

Xtream Gold $209.98
100 Mbps / Family TV / Unlimited LD / TiVo box / Showtime or HBO

Xtream Platinum $229.98
100 Mbps / Family TV / Unlimited LD / TiVo box / All Movie channels

Modem $10
Settop $10

Dish Network is a large satellite provider and has customers in Le Sueur County. The company had around 10.3 million cable customers nationwide at the end of the third quarter of 2018. Dish Network can be bought as a standalone service and is also available as a bundle for Frontier customers.

Dish Network now also offers an Internet-based cable product branded as Sling TV. This service offers an abbreviated channel line-up and costs less than traditional cable products.

DirecTV is one of the largest cable providers in the US with 19.6 million customers at the end of the third quarter of 2018. DirecTV merged with AT&T in 2015. In Le Sueur County, DirecTV is available as a standalone service and is also available as part of a service bundle with CenturyLink. DirecTV now offers an online version of its programming called DirecTV Now.

WISPs (Wireless ISPs)

The county is served by a number of WISPs (wireless ISPs). These companies used a technology called fixed wireless where they mount a transmitter on a tower or other tall structure like a grain elevator or water tower. They then beam broadband to customers which is received through a dish receiver. All of the products sold by these companies are “up-to” speeds. The speed that a customer can receive is affected by the distance to the transmitting tower.

MVTV Wireless is a nonprofit cooperative with headquarters in Granite Falls. They cover 30,000 square miles in southwestern Minnesota. Their web site is https://www.mvtvwireless.com/.

Following are their listed broadband prices:

3 Mbps	$39.95
5 Mbps	$59.95
7 Mbps	$69.95
10 Mbps	$74.95
25 Mbps	$99.95

LTD Broadband is headquartered in Blooming Prairie, Minnesota. The company has over 1,100 tower sites and serves 35,000 square miles in southern Minnesota and northern Iowa. The company claims to be the fourth largest fixed wireless WISP in the country. The company was awarded a federal grant in the recently completed CAF II reverse auction and will be using some of that grant to benefit Le Sueur County. The grant award expects the company to be deliver speeds of at least 25/3 Mbps. The company's web site is at https://ltdbroadband.com/.

Their listed broadband prices are:

3/0.5 Mbps	$40.00
6/1 Mbps	$60.00
10/2 Mbps	$80.00
25/3 Mbps	$90.00

Northfield is headquartered in Northfield, Minnesota and has been offering wireless Internet since 2006. The company's web site is: http://www.northfieldwifi.com/.

Their list wireless broadband prices are:

3/1.5 Mbps	$39.99
8/3 Mbps	$44.99
15/4 Mbps	$54.99
30/6 Mbps	$69.99

XtraTyme

XtraTyme was just entering the county as we were doing this report. The company doesn't post their rates online, other than a note that they are competitive.

http://www.xtratyme.com/

Radiolink is a WISP with headquarters in Ellendale, Minnesota. Their service map shows coverage starting south of Montgomery. Their website is at https://www.radiolinkinternet.com/.

Their list prices for wireless broadband are:

3/2 Mbps	$30.00
5/3 Mbps	$45.00
15/5 Mbps	$55.00
22/7 Mbps	$65.00
30/10 Mbps	$85.00

Speeds up to 300 Mbps available in some areas.

MidCo is a regional cable company that operates an extensive cable network. The company is headquartered in Sioux Falls, South Dakota and has most of their customers in North and South Dakota, but with some in Minnesota and Wisconsin. The company has approximately 1.2 million customers and provides service in over 200 communities.

Midco was formed in 1999 when the customers from Midcontinent Media and AT&T (then called TCI for the cable business) merged their operations in North and South Dakota. The company then grew more by acquisition and purchased customers from the bankrupt Adelphia, from Charter Communications, and from US Cable.

The company operates a regional sports network that carries college sports from North and South Dakota.

The company recently won a grant award from the CAF II reverse auction. In that award the company pledged to provide fixed wireless service capable of at least 100 Mbps across a large area that includes some of Le Sueur County. The company has six years to construct this network. The company has not yet disclosed the prices for the wireless broadband.

Satellite Broadband. There are a number of satellite providers available in the county. In each case, the availability depends upon the ability to have a clear line of sight from a satellite dish to the satellites. The top four providers in the country are Exede (which also markets under the name of Wildblue), HughesNet, DishNet, and StarBand.

In general, there are several issues with using satellite broadband. First is latency, which means delay in the signal. When an Internet connection must travel to and from a satellite, there is a noticeable delay; that delay makes it hard or impossible to do real-time transactions on the web. Current satellite latency can be as high as 900 milliseconds. Any latency above 100 milliseconds creates problems with any real-time applications such as streaming video, voice over IP, gaming, web sites that require real-time such as education courses and testing, or making connections to corporate WANs (for working at home). When the latency gets too high such services won't work at all. Any website or service that requires you to maintain a constant connection will perform poorly, if at all, with a satellite connection.

The second biggest issue for satellite broadband is that many of the products have small data caps – however, there are now a handful of unlimited data plans. These caps limit the amount of data a customer can download in a given month. All of the services require contracts of up to 2 years. Here is a short summary of the four providers:

Exede (Wildblue) uses the newest satellite and uses technology that has meant a significant increase in download speeds. Exede touts speeds up to 17 Mbps download although customer reviews say the average speed is more like 12 Mbps. Still, that makes it the fastest satellite service. They also tout an upload speed

of almost 5 Mbps. The company launched a new satellite, ViaSat II, that will allow for services up to 200 Mbps. But most customers on the new satellite will probably stay on the same products offered today. That satellite will go into service in 2019.

Monthly plans range from $49.99 to $129.99 per month and vary by the size of the monthly data cap. There is also a $9.99 monthly fee for the modem as well as a $149.99 installation fee. The basic package comes with a monthly allowance of 10 gigabits of total download (same as the largest cellular plans). The premium service has a cap of 25 gigabits. This puts the price per gigabit at $5.50, about half the price of cellular data. Exede does allow unlimited download at night.

HughesNet is the oldest satellite provider. They have recently upgraded their satellites and now offer speeds advertised as 8 Mbps download and 0.4 Mbps upload. Their prices range from $49.99 to $129.99. The smallest package has a 10 gigabit download limit per month and the largest one is 20 gigabits. When including the $9.99 cost for the modem, the premium package equates to $7 per downloaded gigabit.

DishNet is associated with Dish networks and can be bundled with their cable product. DishNet prices range from $49.99 to $79.99. They also charge $10 monthly for the modem. They have download speeds of 7 Mbps and upload at 0.8 Mbps. The monthly caps range from 10 gigabits per month on the smallest plan to 50 gigabits on the larger plan. For the largest plan, this works out to $1.80 per downloaded gigabit, making them the most affordable satellite provider.

StarBand is a legacy satellite provider that works on older satellites. Their prices range from $59.99 to $119.99 with a $14.99 monthly charge for the modem. Their data caps range from 1 gigabit for the smallest plan up to 5 gigabits on the largest plan. That works out to a cost of $27 per downloaded gigabit for the largest plan, making them probably the most expensive broadband per gigabit in the country.

Cellular Data

There are four primary cellular companies in the country—AT&T, Verizon, T-Mobile, and Sprint. Only Verizon and AT&T have their own cell sites in rural counties like Le Sueur, and the other two carriers most normally pay to use those networks.

There are almost certainly some households in the county that use their cellphone data plans for household broadband. There are several problems with this. First, customer speeds decrease with distance from a cellphone tower. Speeds for cellular data generally are not fast. There are two different cellular data standards in use: 3G and 4G. 3G data speeds are capped by the technology at 3.1 Mbps download and 0.5 Mbps upload. Most rural 4G networks operate at about 12 Mbps download and the upload varies by service provider. For both of these standards, actual speeds in the field will vary by distance from the tower as well as by how busy a tower is, meaning actual speeds in rural areas tend to be fairly slow for most customers. Actual average 4G bandwidth in the country is just over 11 Mbps. However, speeds in rural areas are largely determined by how far a customer is from a cell site.

While cellular data avoids the latency issue of satellite data, it is more expensive per downloaded gigabit than satellite data and for most customers will be slower.

All four carriers now offer "unlimited" data plans. These plans are not actually unlimited and have monthly data caps in the range of 20+ gigabytes per month of downloaded data. These plans might provide some relief to homes that rely on cellular broadband, although there have been reports of Verizon disconnecting rural customers who use too much data on these plans. These plans allow a far smaller amount of broadband when using the cellphone as a hotspot, so the plans are not much more useful for home broadband that normal cellular plans.

B. The Connect America Fund

There are two federal broadband programs that come from the Connect America Fund, which is part of the FCC's Universal Service Fund. Funding from these two programs will be used to improve broadband in some parts of the county.

The Universal Service Fund today is funded primarily from surcharges on telephony revenues. Originally, the USF was funded by surcharges on landline telephones and special access circuits only, but eventually a surcharge was also placed on cellphones.

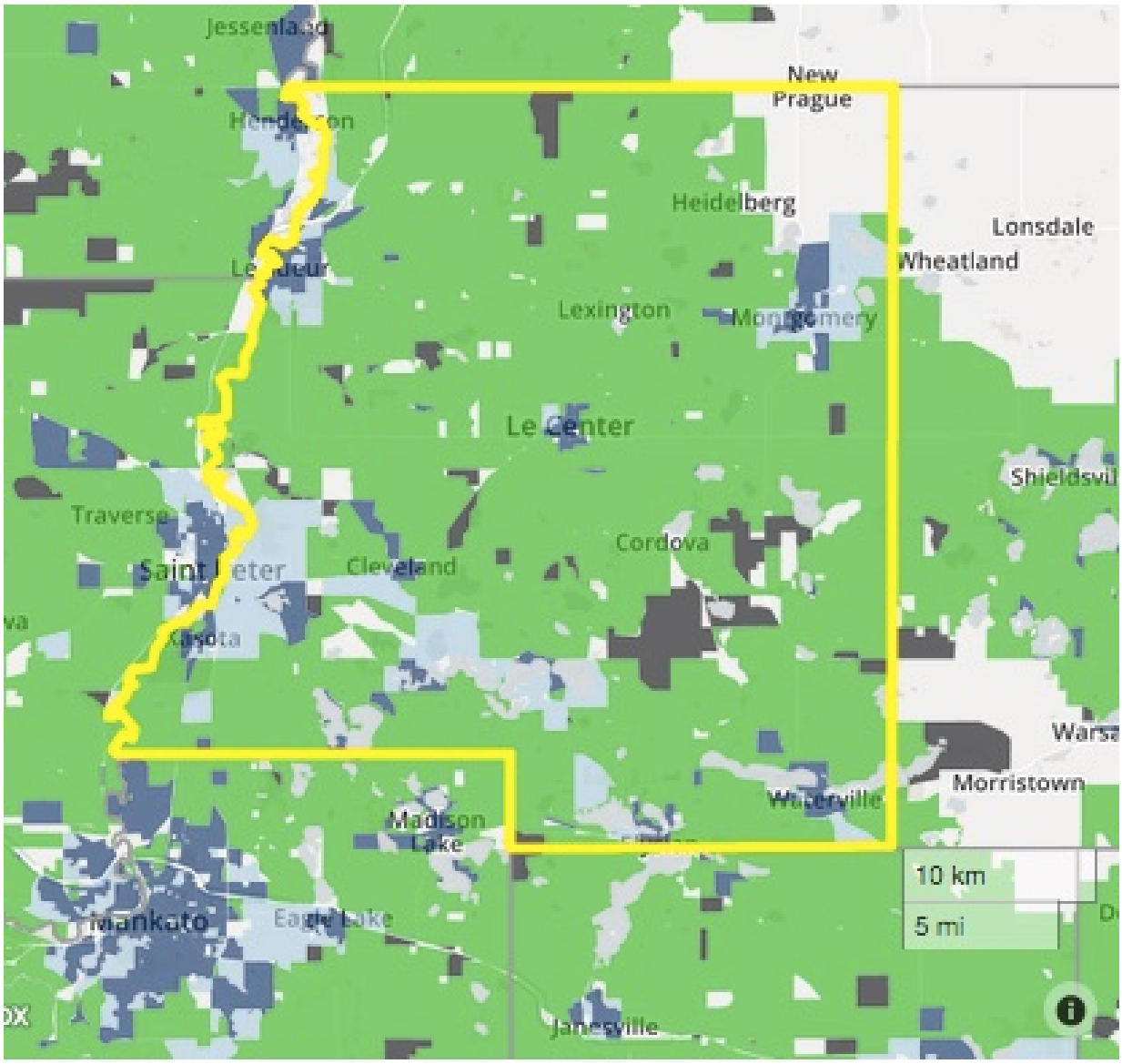
The first program is aimed at the largest telcos like CenturyLink and Frontier Communications and is called Connect America Fund II (CAF II). The FCC has set aside $1.7 billion per year for the 6 years starting with 2016 to build or upgrade rural broadband. These funds were made available to census blocks that have little or no broadband today.

The FCC awards were as follows:

- The FCC awarded $1,579,260 per year for 6 years ($9,475,560 in total) to expand broadband in Le Sueur County.
- CenturyLink accepted funding of $582,795 per year, or $3,496,770, to bring better broadband to 938 rural households in their service area.
- Frontier Communications accepted $924,923 per year, or $5,549,538, to bring better broadband to 1,748 rural customers.
- Consolidated Communications accepted $71,542 per year, or $429,252, to bring faster broadband to 173 rural customers.
- This is a significant investment to make in the county and is about $3,314 per household.

These funds are being distributed to the telcos over 6 years, with the final year being 2020. There are buildout requirements and the telcos should have upgraded at least 60% of the customers in the whole state as of the end of 2018. That doesn't mean that they would have upgraded that many in the county. The upgrades are supposed to all be done by the end of 2020.

The two big telcos both originally said that they planned to use the CAF II money to improve rural DSL. However, Frontier has subsequently said that in some places they will use fixed wireless (the same technology used by the WISPs described earlier). The CAF II program requires that customers must be upgraded to data speeds of at least 10 Mbps download and 1 Mbps upload. Note that those speeds are far slower than the FCC's own definition of broadband, which is 25 Mbps download and 3 Mbps upload. The following map shows the parts of the county that are getting the CAF II upgrades – shown in green. As you can see, this covers most of the rural parts of the county outside of the towns and the parts of the county served by smaller telcos.



In 2018 there was a second round of Connect America Fund awards that are commonly referred to as the Reverse auction. The awards were made under FCC auction 903. In this grant program ISPs bid against each other, with the winner being an ISP willing to take the smallest amount of funding per customer. The winners of the Reverse Auction will receive their funding over 10 years and have 6 years to build the promised networks. Each winning bidder defined the speed of the technology they would deploy and are expected by the FCC to meet those speeds. An ISP that doesn't meet the speeds will have to return some of the grant funding.

The two winners of the Reverse Auction in the county are LTD Broadband and Midco – both deploying fixed wireless technology. LTD will be deploying fixed wireless that meets speeds of at least 25/3 Mbps. Midco pledged to deliver fixed wireless speeds of at least 100 Mbps.

C. The Consequences of Poor Broadband

Like many counties in Minnesota there are rural areas that have, or will be getting, fiber. This means the county will become a mixture of fiber "haves" and "have nots" often living within close proximity to each other. For example, the areas served by Woodstock Communications already have fiber while those nearby will not. The Walnut Grove area served by Redwood County Telephone Company will be getting fiber over the next few years. And while the towns in the county don't have fiber, they are served by Mediacom and Vast Broadband with cable TV networks that are capable today of speeds up to 200 Mbps. Both cable companies have said they will be making network upgrades to further improve broadband speeds.

Le Sueur County is a bit different than many parts of Minnesota in that the rural households and businesses in the county have some broadband options. The rural parts of the county are covered (or soon will be fully covered) by wireless point-to-multipoint technology that can deliver speeds of around 25 Mbps download. Many of these customers are also going to see improved DSL from CenturyLink and Frontier. The rural DSL is likely extremely slow or even unavailable today, but after the CAF II upgrades much of the county will get DSL with speeds of at least 10 Mbps download. We would guess that speeds will likely be faster than that if these telcos want to compete against the wireless broadband. The bottom line is that residents have broadband options today.

The speeds available in the county are going to be sufficient for most homes and businesses in the area today. But there are significant economic implications for having parts of the county without good broadband. Lack of broadband causes all kinds of problems for rural homeowners including:

- Lower Property Values: There are numerous studies showing that homes without broadband are worth less than similarly placed homes with broadband. Realtors have been reporting across the country that broadband is at or near the top of the wish list for most homebuyers today. This means it is going to become hard to attract people to live in the rural parts of the county and, more significantly, homes without broadband are going to become harder to sell. Without a broadband solution, the rural parts of the county are going to become undesirable places to live, and this is only going to get worse over time as broadband speeds keep increasing in the places that have broadband.

  In Le Sueur County, this might mean that the rural areas without broadband will fare poorly over time compared to those parts of the county with good broadband. It is likely to become easier to sell a home or to build a new home where there is fiber. And it is likely that this will lower the property values in the areas without broadband.

  This also has implications for economic development. For example, it's not hard to foresee companies that would rather operate in a part of the county that has fiber rather than locating in places that don't have it.

- Education: We talked to all of the schools in the county. Some schools today are served by wireless broadband and the bandwidth available to them fluctuates, making it hard for the schools to rely on the bandwidth.

But the bigger concern in the schools is that they are unable to send computer-based work home with students since they know that many of them don't have good home Internet. Many surrounding counties have given iPads to kids and let them take them home, but that is impractical in Le Sueur.

It's incredibly hard to raise kids today in a home without adequate broadband. The issue is not just data speeds, but also the total amount of downloaded data that even elementary students need to do homework. This is one of the major problems with satellite broadband, which has speeds up to 15 Mbps, but with tiny data caps that make it impractical for a home with children. The same is true with cellular data; we have heard horror stories of people with kids ending up with astronomical broadband bills for using broadband from cellphone hotspots for home use.

Schools want students to be able to use broadband outside the school. An increasingly common practice in places with adequate broadband is to have students watch video content at home as homework and then discuss it later in the classroom. That frees valuable classroom time from watching video in class. The whole education process is increasingly moving to the web and kids without access to the web are lacking the tools that their peers take for granted.

- Working at Home: More and more jobs today can be done at home, even if only part time. But people living without adequate broadband can't participate in this part of the economy. Increasingly, companies are willing to hire people who work out of their homes. The beauty of such jobs is that they can be done from anywhere.

  Many of your residents commute to jobs in other counties and many of those employers would allow commuters to work a few days a week from home if they had an adequate broadband connection. Telecommuting is good for everybody. Avoiding a commute to a distant office saves a lot of money for employees. After years of experiments with telecommuting, companies have seen that employees are often more productive from home due to missing the various distractions that are in the work environment. Commuting is also a greener alternative, saving a lot of gasoline and cutting down on carbon dioxide emissions.

- Shopping: It's almost impossible to think about using broadband today without thinking about ecommerce on the web. Shopping from Amazon, the giant of the industry, as well as countless other retailers has allowed rural America to buy things for homes and businesses that were hard or impossible to find just a decade ago.

- Taking Part in the Modern World: People with good broadband have access to features of the web that require bandwidth. Households with good bandwidth routinely use broadband for things like watching videos on services like Netflix, talking to friends and family on services like Skype, playing video games (many of which have largely moved online), taking online courses from numerous colleges, or even just browsing today's video-rich Internet. Many of the businesses people now interact with (utilities, insurance companies, shipping companies, etc.) assume that people have a broadband connection. Many people's social lives, for better or worse, have moved to the web; it is not uncommon to now have friends all over the country based upon some shared interest instead of based upon geographic proximity. Homes without broadband can't participate in any of these many activities and services available on the web.

- Medical: There has been talk for well over a decade of the Internet improving medical care in rural areas and for the elderly. We are finally starting to see some of this come to pass. There are now the beginnings of telemedicine in rural Minnesota and other rural areas where patients are able to connect to specialists in the urban areas without having to make the long drive in for an appointment. We now see support for children with special needs being provided by Skype. Over the next decade, telemedicine is expected to become routine. For residents without good broadband in their homes, telemedicine is being done from doctor's offices in county seats and other towns with broadband.

  One of the most recent and common uses of broadband in the medical world is using medical telemetry devices, which might be something like a specialized Fitbit, that can monitor patients after they've had medical procedures. For example, Saint Vincent Health System in Erie, Pennsylvania has been using these technologies and has lowered readmission rates of patients after surgery by 44%.

  In the last few years there have been over 100 start-up companies exploring technologies that will allow people to stay in their home longer as they age. Most of the new technologies being explored involve the use of real broadband. There are dozens of different approaches being investigated and it's certain that some of these technologies will be in play within the coming decade. This is one use of broadband that looks to be sufficiently funded because these new technologies are competing with the extraordinarily high cost of moving elderly people to institutional care.

- Agriculture: The agriculture industry is starting to rely on broadband to a significant degree. There are numerous new inventions like drone farm equipment, sensors that monitor crops or livestock, or useful software services in the cloud that are of huge benefit to farmers. Farming areas without broadband are going to be at a competitive disadvantage to those with broadband. It's expected that the use of sensors and monitors that look at soil wetness, pests, nutrient levels and other key metrics will have significantly higher yields than farms using older technologies.

- Economic Development and Jobs: One of the major issues that concerns most rural counties is the ability to retain the businesses that already operate there and to hopefully attract new ones. As vital as broadband is to residents it's even more vital to businesses. Many businesses now want their employees to have broadband at home so that they can work from home as needed while gaining access to data in company servers. A new business is going to consider the whole broadband profile of an area before deciding to locate there.

  The other related issue that we often hear about is what is called the "rural brain drain." Most rural counties don't have enough good jobs to keep graduates home, and so large percentages of each graduating class migrate to larger cities and towns to pursue careers. One of the promises of fiber is the ability to create new jobs and to also provide the opportunity for people to either work at home or to create new businesses that allow them to stay where they want to live. There are numerous municipal fiber ventures that claim significant economic benefits from fiber networks they've built. Many of them have been able to lure new businesses or have seen existing businesses expand.

II. ENGINEERING DESIGN AND COSTS

Finley Engineering performed an engineering analysis and prepared a cost estimate of the cost of building fiber in areas of the county that don't meet the state's goal of having broadband capable of 100 Mbps download speeds.

A. Network Design

Before looking at the specific network designs, we gathered information about the county demographics for use in all of the scenarios. Following is a description of the data we gathered and the approach we took to the engineering analysis.

Study Area

The county elected to look at a study that brings broadband to all parts of the county that are either unserved or underserved today and for which there are no plans to bring fiber in the next few years. We started by looking at maps of existing service levels and found that most of the towns and cities meet the state's 2026 goal of 100Mbps download and 20Mbps upload. We also found that there are a few pockets that have access to these higher speeds. They are the northwest corner of the county which is served by Lonsdale Telephone and Bevcomm with fiber. There are also some portions of the lakes in the southern half of the state that have access to fiber or cable service. Jaguar Communications operates a backbone route along roads in the county and serves customers with fiber who live along those routes. There are also portions of the county that have upgraded DSL that meet the state's 2020 speed goals of 25 Mbps download and 3 Mbps upload.

We contacted all of the local service providers in the county. We inquired about the level of broadband service they offer today and asked about plans for future broadband upgrades. Below is a summary of what we learned:

1. Bevcomm – The company operates the New Prague Exchange in the northeast corner of the county. These areas were mostly excluded from the study since the company is using federal ACAM funding to build fiber-to-the-home throughout these exchanges. A large portion of this area is already served by FTTH and the company is committed to building fiber to the remainder of the exchange over the next 2-5 years.
2. Lonsdale Telephone – The company serves the Lonsdale exchange in the northwest part of the county. This area has already been fully built with an FTTH network. This area was excluded from all of the studies.
3. CenturyLink – CenturyLink operates the St. Peter and Le Sueur exchanges in the county. They have taken federal CAF II funding to increase service levels in their existing service territories. That federal program mandates that the company increase broadband speeds to at least 10/1 Mbps. CenturyLink is updating the DSL on their existing copper networks and has no plans to build fiber. These areas are included in all versions of the study with the exception of the city limits of St. Peter and Le Sueur where there are multiple other service providers.
4. Frontier Communications – The company operates the Belle Plaine, Le Center, Montgomery, Kilkenny, Waterville, and Elysian exchanges in the county. They have taken federal CAF II funding to increase service levels in their existing service territories. Frontier indicated that they are adding remotes electronics and increasing broadband speeds to meet or exceed the 10/1 Mbps

federal mandate. However, the upgrades might not be fully completed until well into 2020. These areas are included in all versions of the study with the exception of a few locations where other service providers are offering speeds in excess of 100/20Mbps service.

5. Consolidated Communications – The company operates the Mankato and Madison Lake exchanges in the southwestern part of the county. They generally operate a DSL network fed by some fiber. These areas largely have access to 25/3 Mbps broadband speeds. This means they were excluded from the scenario that looks to build to unserved locations but included in the scenario that brings fiber to areas that don't meet the state's goal of 100/20 Mbps.
6. Jaguar Communications – The company operates a middle-mile network of fiber that runs throughout parts of the county. The company is offering fiber broadband to customers that live along those fibers. These areas were excluded from all versions of the study.
7. Mediacom – The company provides broadband and cable TV service in the towns of Le Center, St. Peter, Cleveland, Le Sueur, and Montgomery over their existing cable plant with speeds of up to 1 gigabit per second. These areas were excluded from all versions of the study.
8. Midco – Midco is a cable company that provides service in Waterville. This service uses their existing cable plant and is capable of speeds of up to 200 Mbps. The company has been upgrading other systems to be capable of speeds of up to 1 Gbps, so this network could be upgraded in the future.

   Midco also recently won a significant grant in the FCC's recent CAF II Reverse Auction. Midco recent purchased a fixed wireless company from North Dakota called Invisimax and plans to rebrand the company as Midco Wireless. Midco plans to build a fixed wireless network to cover much of Le Sueur County along with a lot of other counties in southern Minnesota. In the auction the company pledged to deliver service of 100/20 Mbps. The company has 6 years to build this network and we don't know when it will be coming to the county.
9. Fixed Wireless – There are other fixed wireless companies operating in the county including MVTV, Xtratyme, Northfield, LTD Broadband, and Radiolink. These all advertise service with speeds up to 25/3Mbps or even slightly more in various parts of the county. These areas were included in the studies.

Passings: The telecom industry uses the term "passing" to mean any home or business that is near enough to a network to be a potential customer. We verified passings through the use of county GIS information that show the location of all occupied buildings in the study area. We classified the passings by speed that they had access to according to various public reporting sites such as FCC 477 data and maps from the MN Department of Employment and Economic Development. With this information we determined the following number of passings by township:

	Unserved < 25 Mbps	Underserved < 100 Mbps
Cleveland	148	2
Cordova	217	0
Derrynane	154	13
Elysian	255	30
Kasada	31	265
Kilkenny	238	0
Lanesburgh	132	142

LeSueur	98	0
Lexington	237	0
Montgomery	233	0
Ottowa	136	2
Sharon	186	0
Tyrone	183	0
Washington	30	30
Waterville	270	201
Total	2,548	685

Road Miles: Le Sueur County has an extensive GIS mapping system. This information was used as the primary resource for the road miles for the study. Analysis of the GIS data, satellite imagery, and also MNDOT maps of streets and roads were used to determine fiber routes in the study area. The study includes roads that are maintained all year, meaning they are plowed when it snows. Our study is conservative in that it assumes that fiber would be built along nearly all of these roads. It's likely in a detailed design that some efficiencies could be found that would result in small reductions in the road miles that need fiber.

The miles of fiber construction required differs for each scenario, summarized as follows:

Ring (for every scenario)	74.6 miles
Unserved Areas excluding Bevcomm	537.8 miles
Unserved Areas including Bevcomm	559.8 miles
Areas without 100/2 Mbps excluding Bevcomm	582.3 miles
Areas without 100/2 Mbps including Bevcomm	615.8 miles

Basic Network Design

Fiber Backbone

The network design utilizes the construction of a backbone fiber. A map of the proposed fiber backbone is shown as Exhibit III. The purpose of the fiber backbone is to provide a path to bring fiber signal to and from the fiber nodes in the different network configurations.

The backbone we have chosen is 74.6 miles long. Obviously other routes could be chosen to reach the same or similar locations. The backbone is designed in a ring configuration, meaning it completes a full circular path. The primary reason for the ring design is that the fiber network can self-heal if there is a fiber cut so that the nodes on the ring don't lose service. Without a ring, significant numbers of customers could lose service with a fiber cut on the backbone fiber.

Our design contemplates that one service provider would serve the whole rural part of the county. It's possible that instead multiple service providers might serve different parts of the county. If existing service providers edge out from their current service territories, a ring might not be used – or the service providers might work together to create the ring.

There are already several fibers owned by service providers that run through parts of the county. However, in many cases those fiber routes have not been designed to serve customers along the road as is being done by Jaguar Communications. This means that fiber still needs to be built along these routes in order to bring fiber to everybody.

The backbone was configured to feed the electronics huts and the electronics are strategically located to feed the most customers. It is possible the huts could be located elsewhere depending on the service provider and their existing network, but we think the number of huts we are projecting are needed to serve the whole area. In addition to the huts there are some small splitter cabinets located throughout the county. These are purely passive locations (no power required) that house fiber optic splitters and that would reduce fiber count and cost of the design.

In the study we located electronics huts in:

1. Derrynane – This location would serve most of the northern and northwestern portions of the county.
2. Cleveland – This site is between St Peter and Cleveland and would serve most of the southwest portion of the county. This site also would serve nearby splitter cabinets to keep counts low.
3. Elysian – This would most likely be a small electronics cabinet or hut site that would serve customers in the southern part of the county.
4. Kilkenny – This location would serve customers in the southeastern part of the county.

We designed the remote electronics huts to be large enough to accommodate all electronics, batteries, and equipment that would be required along with some spare capacity for future growth. In all scenarios, we based pricing upon recent quotes we have received from vendors like Calix, AdTran, Clearfield, Cienna, and others. Finley is not proposing any specific vendors as we are vendor neutral. The costs chosen are representative of current electronic costs.

Fiber Network

We considered several options for an all-fiber design. There are several key factors to consider in the design of a rural fiber network:

- Whether to use buried fiber, aerial fiber, or some mix of the two.
- The design of the fiber electronics.

Since we don’t know if one or more of the existing providers in the area might build broadband to the study area, we designed a network adequate to serve the whole study area that stands on its own in terms of a design. As mentioned earlier, that design assumes a fiber backbone and also the construction of three fiber nodes plus a core location to hold electronics.

However, should the existing providers build out from existing fiber networks there would likely be some savings from our cost estimates. For example, a network might be designed with fewer huts if existing huts could be utilized. If the network was designed without a fiber backbone or incorporated into existing backbones by different providers, there could be savings on the fiber costs and electronics.

We took the most conservative approach to the design. The network has been designed as if only one service provider would serve the whole area. In doing so we have not started with any assumption that there are existing fiber assets that might benefit the fiber build. This means that our estimated costs are, by definition, conservatively high.

In Le Sueur County, the soil is mostly soft and deep and would allow for easy construction for buried fiber. The exception would be on the western edge of the county along the Minnesota River. We have also accounted for lakeside construction, which is usually more expensive due to wet soils, additional boring requirements, and higher density of potential subscribers. Finley determined that it is probably not any more expensive to bury the rural fiber compared to putting the fiber on poles in those places where there are poles. An all-buried design has the added operational advantage of having lower future maintenance costs. The one downside to a buried network is that it is more susceptible to fiber cuts by anybody doing rural excavation near roads or at the end of driveways, and it is likely that a buried fiber network would incur these fiber cuts from time to time. This is another reason to utilize redundant network paths so that a single cut would not take the network down.

For electronics, the first design issue to consider is whether to centralize or distribute the electronics in the network. The second design issue looks at using a star versus a ring topology. A third issue in the design is to determine whether to use distributed splitter locations or local convergence points for splitter locations.

We chose the locations of the huts so that no customer was more than 12 miles away from a hut, the maximum recommended distance for a signal on a FTTH network. That is 12 miles of fiber along a road, not a 12-mile circle. The study shows the need for four locations to act as PON local originating points.

The huts were designed using prefabricated buildings that are designed to weather all seasons of the year. These buildings are relatively inexpensive and allow for future flexibility.

Due to the concentration of customers in small pockets around lakes and small towns, we elected to use a combination of remote splitter cabinets and splitters in the remote huts. From each splitter cabinet or hut there is a dedicated fiber built to each customer. This would allow for the option of serving customers with either passive optical network (PON) electronics or with active Ethernet. The remote splitter cabinets would not require electronics.

We chose to use PON electronics because that technology today is about 15% less expensive than active Ethernet. The major difference in the two technologies is the number of lasers in the network. In a PON network, one laser in a hut can light up to 64 home lasers (although it’s more typical to light no more than 32 or 16). With active Ethernet there must be one laser in a hut for every laser at a home or business.

The cost of the network was determined using pricing of PON electronics. A GPON network shares 2.4G downstream and 1.2G upstream which is split between the numbers of subscribers attached to a GPON splitters with 64, 32 or 16 ports. An active Ethernet port provides up to 1 Gbps of upstream and downstream data to customers today and would be upgradable to 10 Gbps. There are not likely to be any customers in the rural parts of the county that would insist on having a dedicated Ethernet feed, which requires active Ethernet technology. An end user will want a dedicated feed when they don’t want to share bandwidth with other customers anywhere in the network, and that sort of requirement is generally only

made by very large data users, like a school system, or security-conscious customers like a military or government building. While we designed a 100% PON network, the fiber design has enough spare fiber pairs that would allow some customers to be served directly with active Ethernet.

In the design, Finley used large enough fibers for each part of the network to accommodate potential customers in a given area. It's impossible in a competitive environment to know the exact location of customers and there may be a higher penetration rate of customers in different parts of the network. We accounted for this by making sure there is enough fibers to serve everybody along with fibers to accommodate future growth. The fibers were also sized to account for any fibers that might go bad over time.

When designing FTTH networks, there are options for how many customers to serve from one neighborhood fiber point. The technology will allow up to 64 customers to share a PON system. Since there are not many customers in the rural areas, the rural network was designed with a 1x16 fiber split while the towns were designed with a 1x32 fiber split. Having a lower split allows the signal to travel farther. It's possible in a final design, once the exact location of the huts are known, that the splits will be different than what we've estimated.

In pricing the fiber construction, Finley used pricing from recent construction of fiber in Minnesota in similar conditions (soil type). The labor in the forecasts was estimated at current market rates and does not include the prevailing wage rate.

Fiber Drops

Through sampling using Google Earth we determined that the average length for a fiber drop (the distance between the road and homes) is about 200 feet. That is a longer length than we see in some counties and is mostly due to the fact that almost all of the customers in the study area are rural. Drops in towns are generally significantly shorter. This longer drop length adds significant extra cost to the cost of reaching homes in the rural areas.

Customer Electronics

The electronic device used at customer homes is referred to in the industry as an ONT (optical network terminal). This is an electronic device that contains a laser that can communicate with the laser in the serving hut.

Traditionally, ONTs were placed on the outside of buildings in a small enclosure and powered by tapping into the electricity after the power meter. Today there is also an ONT that can be placed indoors and which plugs into an outlet, much like the cable modems used by cable companies. Some companies still put the ONT on the outside of the home to give their technicians 24/7 access to the units. Other providers are electing internal units because of the greater protection from the weather. The industry is still split on this choice, but it appears that internal ONTs are becoming the most predominant choice for new construction. The cost of the two kinds of units is nearly identical and so the study doesn't choose between the two types of units.

ONTs are also available in multiple configurations. The most common unit is the one that can be used to serve either homes or small businesses, with larger units designed to serve large businesses. The study assumes that only the smaller standard units are used since we don't think there are any complex businesses in the service area. The network could easily accommodate larger ONTs if needed.

This design uses ONTs that are designed to deliver only voice and data. There are older ONTs on the market that allow for delivery of a separate analog TV data path, but newer networks assume that the cable TV offering will be digital and delivered over the IP data path.

Other Capital Costs and Considerations

Following are some of the additional capital costs that we considered in the financial models.

Headend Capital: The studies assume that any ISP that builds to these rural areas will already be delivering broadband products elsewhere or will be able to buy these services from one of the existing ISPs in the area. We did not build in the cost of a headend used to provide products like broadband, telephone service, and cable TV. Such a headend would be prohibitively expensive if used for the small customer base in the county.

The business plans include the electronics needed at the customer location to provide voice and broadband services. Since many of the service providers in the area don't offer cable TV, we did not include the cost of settop boxes. Most service providers charge a monthly fee for each box and the box rentals are profitable, so it would not be a material change for a service provider to account for these.

Other Assets: The business plan also includes the other assets needed to operate the business. This includes new vehicles for the outside technician. The business plan includes a computer for every employee along with furniture and office equipment.

Inventory/Spares: The business plan includes inventory. This inventory consists of spare fiber, settop boxes, ONTs, and spare cards for all the electronics.

Battery Backup: Historically, engineers designed many FTTH networks with battery backup for the ONT. However, many small fiber providers have stopped providing batteries. The batteries were installed to provide power to telephones in the case of a power outage at the home. However, there are fewer and fewer phones in existence that are powered from the phone line and most phones must be plugged into an outlet. When such a phone loses power it can't be powered by the battery. Our design does not include a battery backup, but a provider could provide optional batteries for customers who really want one.

B. Network Cost Estimates

Following are the cost estimates for constructing the network and the other assets needed for each business plan scenario.

Capital Assumptions in the Study

Capital is the industry term for the assets required to operate the business. The capital expenditures predicted in these models reflect the results of the engineering studies referenced in Section II.A of the report. The launch of a broadband network requires a significant investment in the fiber network and electronics and these items represent most of the cost of getting into the business.

Below is a summary of the specific capital assets needed for each base scenario. The amount of capital investment required varies by the technology used as well as by the number of customers covered by a given scenario.

Telecom capital includes several broad categories of equipment including fiber cable, electronics for FTTH, huts and wireless towers, wireless electronics, and customer devices like cable settop boxes, VoIP gateways, and WiFi modems. In addition to capital needed for the network, there are operational capital costs predicted for assets like furniture, buildings, computers, vehicles, tools, inventory, and capitalized software.

We have tried to be realistic in our estimates so that hopefully the actual cost of construction will be something lower than our projections. One way we were conservative was by adding a 10% construction contingency to the cost of the primary assets to cover any cost overruns.

However, it is important to remember that the engineering used to make these estimates is high level. Detailed engineering is expensive and would involve having an engineer examine all places in the potential network to look at local construction conditions. That kind of engineering is generally not done until a project is ready for construction. Instead, the engineering was done using some field examination of the county, but mostly relying upon maps and other tools. Finley has made many such estimates over the years and we know that this level of engineering is generally good enough to assess if a project is worth further consideration.

The studies all assume that the provider of service will not build a new cable TV headend or buy a new voice switch for the provision of cable TV or telephone service. If the new provider is an ISP that already offers those products elsewhere, the assumption is that they would transport in the products over the fiber backbone.

Following is the capital required for the base case for each of the four scenarios at a 70% customer penetration. These represent the capital expended during the first 4 years, which for most projects are covered by borrowing before the business becomes cash positive. The capital costs would be higher or lower if there were greater or fewer customers than the 70% used to calculate these figures.

	Unserved W/O Bevcomm	Unserved W/ Bevcomm
Fiber & Drops	$14,542,391	$15,147,440
Electronics	$ 1,477,747	$ 1,620,832
Huts/Land	$ 343,396	$ 429,245
Operational Assets	$ 212,670	$ 213,160
Total	$16,576,204	$17,420,677

	Whole Area W/O Bevcomm	Whole Area W/ Bevcomm
Fiber & Drops	$15,544,427	$16,590,870
Electronics	$ 1,749,797	$ 1,946,447
Huts/Land	$ 343,396	$ 429,245
Operational Assets	$ 214,625	$ 215,635
Total	$17,852,245	$19,182,197

Customer Costs

Residential Fiber Electronics Costs: The model assumes that the hardware electronics for an ONT cost $400, including the cost of the labor for installation. In the projections it was assumed that the installation would be done by external contractors. It could be less expensive to do installations using existing company personnel at the service providers.

We've assumed that the service provider will supply a WiFi router for customers that want one. We've assumed these routers cost $100.

Fiber Drops: Fiber drops are the fiber that connects between the distribution fiber and a customer's location. In this study the cost of fiber drops is significant. The assumption has been made that with the volume of drops needed plus the anticipated speed of network deployment the drops during the first four years of the project would be installed by external contractors.

The cost for fiber drops are estimated to cost $1,206. Most of that cost is the labor needed to bury drops, with the average drop length estimated at 200 feet.

It might be possible to save some on labor costs if a service provider can assemble their own construction team for the rural drops. But the prices included in the study represent recent pricing being paid in several Minnesota projects to external contractors. Starting in the fifth year there are only a few drops added each month and it's assumed that this would be done by company technicians.

Business Costs

We've only identified ten businesses in the study area. We've assumed that the cost to serve them is the same as with residential homes.

C. Competing Technologies

Following is a more in-depth discussion of the technologies that are currently provided in the rural areas today.

Wireless Technologies

There is always a lot of confusion about wireless technology since there are so many different frequencies in use and different technologies used for each. It is likely that there are rural residents in the county today using the following wireless technologies for broadband:

Cellular Data

There are likely rural customers in the county today that use cellular data for their home broadband – mostly due to lack of other options. US cellular data is possibly the most expensive data among countries with modern networks with prices at $10 per gigabit.

5G is the next generation of cellular service that will eventually replace the current 4G LTE. The new 5G standards propose an improved cellular experience for customers. There are 13 new technical improvements required to fully implement 5G. The most important of these are:

- The primary stated goal of the 5G standard is to be able to handle upwards of 100,000 simultaneous connections from a single cell site. We're all familiar with being unable to get a cell signal in a busy environment like an airport or stadium. This will fix that issue, but the real hope for the cellular companies is to be able to use cellular technology to be able to communicate with Internet of Things devices. IoT is a term that refers to the many devices that we communicate with wireless, such as the many devices in a home today that are connected to WiFi. Today the IoT works almost entirely with WiFi and the cellular companies envision capturing much of that market – but they have a huge uphill battle to wrest the market away from WiFi.
- The standards set a speed goal to eventually achieve widespread cellular speeds of 100 Mbps download and 20 Mbps upload. Contrary to the cellular company press releases, the standards goal of 5G is not to create blazingly fast gigabit cellular service.
- The last important improvement is to achieve latency at near-fiber levels. Latency measures a delay in a signal, and today cellular signals have higher latency than fiber connections. This is the primary reason why it often feels sluggish to download a web page on a cellphone.

It's likely to take 7 or 8 years to introduce all of the improvements. The same thing happened with the transition from 3G and 4G and the first true 4G cell site that fully meets the 4G specifications was just activated in late 2018 – even though the cellular carriers have been selling what they call 4G service for a decade. This gradual introduction of the 5G improvements will mean a gradual improvement of 4G technology. In industry lingo, in 5 years we might see enough of the 5G standards implemented that from a technical perspective we'll be at 4.5G. Until then, from a technical perspective the industry will grow through 4.1G, 4.2G, etc. Even though this will take a decade to be fully implemented, the cellular marketing folks are already making claims about having 5G cellular in 2019.

There are numerous articles on the web that talk about gigabit cellphone speeds. This is mostly due to non-technical writers confusing the three different 5G technologies. But this speculation has also been

fueled by a few announcements of trials done by Verizon and Sprint. Sprint got great press by saying they had achieved a connection to a cellphone at 600 Mbps. This was a highly controlled test. It involved a cellphone that used an immense antenna array that could receive and combine signals from ten different millimeter wave transmitters at the same time. To achieve that same performance in real the real world would require ten small cell sites within close proximity to a cellular customer - a world where there are cellular transmitters literally everywhere. A phone using this antenna array would have a likely battery life of a half hour. The test shows that fast speeds are theoretically possible – in a controlled lab setting. Fast speeds will not be possible in the real world unless the parameters of this same test are met – multiple cell sites nearby, a cellphone with a massive antenna array, the use of ubiquitous millimeter wave spectrum and zero interference. It's worth knowing that almost everything blocks millimeter wave spectrum, even the body of the cellphone user.

The goal of achieving 100 Mbps cellular speeds is due to a major change in the way that the cellular network functions. Today's network is based upon the idea of roaming. For both voice and broadband purposes today's cellphone makes only one connection at a time to the cell tower that provides the strongest signal (and which has an open slot). 5G introduces a radical change and would allow for a handset to connect to multiple cell sites and draw broadband from each of them. This is done using MIMO (multi-input multi-output) antennas that can make and sustain multiple connections. This is the most difficult 5G challenge to implement in the real world. First, in most of the world there will still only be one or perhaps two cell sites in range of a handset. Faster speeds will only be available in places where the carriers have added numerous small cell sites. In practical terms this means that in most places in the US that cellular data speeds will remain at 4G speeds, even after 5G implementation – any place where a customer can see only one cell site will not get faster broadband speeds.

Is 5G cellular going to be a competitive threat for a fiber provider? There are several factors to consider in trying to answer that question.

> What will be the real speeds? As just stated, the goal of 5G is to achieve 100 Mbps speeds – but in places where there is only going to be one cell tower in reach of a customer, like in rural America, the speeds won't increase much over today's 4G speeds.
>
> Cell phone coverage is wonky. What is never discussed when talking about 5G is how wonky all wireless technologies are in the real world. Distance from the cell site is a huge issue, particular for some of the higher frequencies. More important is local interference and propagation issues. As an example, I live in Asheville, NC. It's a hilly and wooded town and at my house I have decent AT&T coverage, but Verizon sometimes has zero bars. I only have to walk a few blocks to find the opposite situation where Verizon is strong and AT&T doesn't work. 5G will not overcome the inherent topographical and interference issues that affect cellular coverage.
>
> Will require significant deployment of small cell sites. To achieve the 100 Mbps means deploying several small cell sites in a neighborhood, and that implies needing fiber in neighborhoods. Many industry experts think that this is will only happen in business district and selected neighborhoods and that the wireless carriers won't be trying to achieve total 100 Mbps coverage even in cities.
>
> Can the Wireless Networks Handle that Much Traffic? For cellular to be a challenge to landline broadband means carrying huge amounts of data on the cellular network. Providing ubiquitous 100

Mbps speeds for customers who are only using their cellphones for broadband would require a several-magnitude increase in the bandwidth carried by the cellular networks. *FierceWireless* along with Strategic Analytics recently did a study on how the customers of the major cellular companies use data. They reported that the average T-Mobile customer in 2018 used 18.4 GB of data per month with 5.3 GB on the cellular network and the rest on WiFi. Sprint customers used 18.2 GB per month with 4.4 GB on the cellular networks. Contrast this with household broadband – OpenVault reported that the average home used 268.7 gigabytes per month, up from 201.6 gigabytes in 2017. While cellular data use is now doubling every 2 years, household broadband usage is still doubling every three years. Cellular networks will need to undergo a 10X increase in throughput to compete with home broadband today. That will require massive increases in backhaul bandwidth costs along with huge capital expenditures to avoid bottlenecks in the networks.

The conclusion is that there are huge economic hurdles for the cellular companies to overcome to try to compete in an urban area as a primary broadband provider. There are even bigger hurdles to deploy a robust cellular network in rural areas. There doesn't seem to be a realistic path for cellular to compete with landline broadband.

Traditional Point-to-Multipoint Broadband

The second kind of wireless network is a point-to-multipoint data network that is transmitted from one central transmitter to many individual points. This is the technology being used in the county today by companies like MYTV Wireless, LTD Broadband, and Radiolink.

There are three current slices of spectrum that can be used for this purpose and two more that will be coming on the market in the next few years:

- 900 MHz: This spectrum has been available for this application for many years. This is the spectrum used back in the 70s and 80s to provide the bandwidth for garage door openers and cordless phones. This spectrum got saturated; in urban areas there were many stories about people opening their neighbors' garage doors when they made a phone call.

  This spectrum can still be used today in a point-to-multipoint radio system. The best characteristic of this spectrum is that it travels well through impediments like trees and it can go for a long distance—over ten miles. The down side is that, since it has a low frequency, the channels aren't very big and it can only deliver a few megabits per second of data speed.

- WiFi: WiFi is short for ***wi****reless* ***fi****delity* and is meant to be used generically when referring to any type of 802.11 network. The FCC has currently set aside two swaths of frequency for WiFi: 2.4 GHz and 5.7 GHz. In a point-to-multipoint network, these two frequencies are often used together. The most common way is to use the higher 5.7 GHz to reach the closest customers and save the lower frequency for customers who are farther away.

  In practical use, in wide-open conditions, these frequencies can be used to serve customers up to about 3–4 miles from a transmitter. They have a theoretical cap of 28 Mbps on the bandwidth that can be delivered, and in ideal conditions they can achieve that much speed. But the signals are

disrupted by trees and leaves and can be degraded by rain, snow, or even just heavy humidity. The ideal condition is in the flat, open southwest desert; everywhere else performs worse than the ideal.

- 3.65 GHz: The FCC authorized the 3.65 GHz–3.70 GHz frequency for trials of public use in 2006 and is just now making it available for widespread use in rural applications. This spectrum is promising because the existing trials showed that it can penetrate trees much better than the 2.4 GHz WiFi.

  There are a few limitations of this spectrum. The spectrum cannot be used close to certain existing government installations or satellite earth stations that use the spectrum. Since these facilities are mostly near to a few submarine bases, it should not be an issue in Minnesota.

  The spectrum will be licensed for a very affordable $280 fee. However, the license is not exclusive, and every user of the spectrum will be expected to coordinate with other users. This is not like a normal FCC license and it is not first come first serve. Everyone using the spectrum in a given area is expected to work with others to minimize interference. The FCC will act as the arbiter if parties can't work this out together.

  There are different rules for using the spectrum depending upon how it is deployed. The FCC rules suggest using radios that use other spectrum in addition to 3.65 GHz. For radios that only use this spectrum the usage is limited to the 25 MHz band between 3.65 and 3.675 GHz. Radios that allow for a shift to other frequencies when there is contention can use the full 50 MHz channel within this frequency.

  The frequency can support bandwidth on one channel up to 37 Mbps download. It's possible to bond channels within the frequency band or with other unlicensed spectrum to get even faster throughput. It's theoretically possible with bonding to get speeds of 100 Mbps.

  Radios for this frequency are readily available from most of the major point-to-multipoint radio manufacturers. The price of the base stations and customer CPE are slightly higher than the cost of radios in the unlicensed bands.

  In practical application, this spectrum can be used to deliver up to 25 Mbps at 6 miles from the transmitter, with more bandwidth for those customers who are closer than that. It can theoretically transmit to the horizon, but at greatly diminished speeds.

- White Space Spectrum: The FCC has been doing trials in what is called white space spectrum. This is spectrum that is the same range as TV channels 13 through 51, in four bands of frequencies in the VHF and UHF regions of 54–72 MHz, 76–88 MHz, 174–216 MHz, and 470–698 MHz. The FCC order refers to whitespace radio devices that will work in the spectrum as TVBD devices.

  The FCC auctioned a lot of this frequency in 2018, with the buyers ranging from the big cellular companies and Comcast. This was called an incentive auction, because TV stations that give up their spectrum got a share of the sale proceeds. The FCC is now expected to make some of this spectrum available for rural broadband. The rules have not yet been worked out, but they will probably be something similar to what governs WiFi and be available to anybody.

There are two possible uses for the spectrum. On a broadcast basis, this can be used to make better hotspots. A 2.4 GHz WiFi signal can deliver just under 100 Mbps out to about 100 meters (300 feet). But it dies quickly after that and there may be only 30 Mbps left at 200 meters and nothing much after that. Whitespace spectrum can deliver just under 50 Mbps out to 600 feet and 25 Mbps out to 1,200 feet.

There is potential for the spectrum to extend point-to-multipoint radio systems in rural areas. White space radios should be able to deliver about 45 Mbps up to about 6 miles from the transmitter. That's easily twice as far as what can be delivered today using unlicensed spectrum. Physics limit this to about 45 Mbps of total bandwidth for a single channel, but it will be possible to bond together multiple channels. While not at fiber speeds, this spectrum can enhance rural broadband. It is likely to be at least a few more years before the FCC releases this spectrum and equipment becomes available from vendors.

One issue to be worked out is that the FCC rules require the radios using this frequency to use what they are calling cognitive sensing. What this means is that an unlicensed user of the spectrum will be required to vacate any requests for usage from a licensed user. While this would not be a problem where there is only one user of the white space spectrum, where there is a mix of licensed and unlicensed users the unlicensed provider needs to pair radios with other spectrums to be able to serve customers when they have to cede usage to a licensed user.

Some wireless ISPs are now advertising speeds as fast as 100 Mbps download. Faster speeds can be achieved by bonding together multiple spectrum paths to a given customer and even multiple channels within the same spectrum. There is a trade-off in the wireless world between speed and the number of customers that can be served from a cellular tower site. To use a simple analogy, if a radio can make 200 individual connections to customers, they could instead make 100 connections if each customer got two channels.

5G Millimeter Wave Point-to-Multipoint Broadband

The newest technology being touted everywhere in the press is 5G broadband using millimeter wave spectrum. If you read many articles about 5G, you'd think that we're on the cusp having wireless broadband brought to most homes in America, providing homes with another option for broadband. This idea was recently bolstered by news that Verizon plans to offer 5G wireless broadband to as many as 11 million homes over the next few years.

This technology uses millimeter wave spectrum. This is spectrum with extremely high frequencies of 24 GHz and higher. The only other common use of this spectrum has been in the full-body scanners at airports. The primary operating characteristic of millimeter wave spectrum is that the signal doesn't travel very far. Most engineers set the realistic distance between 1,000 and 1,500 feet.

Those short distances mean that the technology must rely on the placement of small transmitters on utility poles or street lights. Each transmitter can wirelessly transmit broadband to homes or businesses in the immediate area. Verizon began a trial of the technology late in 2018 and says they are achieving broadband speeds of 300 Mbps – with a hope over time that they can get that up to a gigabit.

Another challenge for the technology is that the millimeter wave spectrum requires a relatively clear path between the transmitter and a dish placed on the home – and that means that 5G is best deployed on straight streets without curves, hills, or dense tree cover.

For a 5G network to deliver fast broadband means bringing fiber to each transmitter. The cost of building fiber to neighborhoods is the biggest barrier to widespread 5G deployment. It's expensive to string fiber in residential neighborhoods. The cost of putting fiber on poles can be expensive if there are already a lot of other wires on the poles (from the electric, cable, and telephone companies). In neighborhoods where other utilities are underground the cost of constructing fiber can be eve n higher.

The technology is only going to make financial sense in a few circumstances. In the case of Verizon, the technology is reasonably affordable since the company will rely on already-existing fiber. An ISP without existing fiber will only deploy 5G where the cost of building fiber or wireless backhaul is reasonably affordable. This means neighborhoods without a lot of impediments like hills, curvy roads, heavy foliage or other impediments that would restrict the performance of the wireless network. This means not building in neighborhoods where the poles are short or don't have enough room to add a new fiber. It means avoiding neighborhoods where the utilities are already buried. An ideal 5G neighborhood is also going to need significant housing density, with houses relatively close together without a lot of empty lots.

This technology is also not suited to downtown areas with high-rises; there are better wireless technologies for delivering a large data connection to a single building, such as the high bandwidth millimeter wave radios used by Webpass. 5G technology also is not going to make a lot of sense where the housing density is too low, such as suburbs with large lots. 5G broadband is definitely not a solution for rural areas where homes and farms are too far apart.

Not all Wireless Technologies Are the Same

Since the county has fairly ubiquitous wireless broadband in the rural areas it's important to understand that there are different wireless technologies and not all are adequate for rural broadband. There are a number of factors that are needed to provide a quality wireless broadband connection:

- **Age of Technology**. The wireless technology deployed in the industry has made huge strides in recent years. Radios that are just a few years old do not have the same capacity as radios that can be purchased today. And even today it's possible to still buy radios with reduced capability and the best radios are significantly more expensive.

- **Using Multiple Frequencies**. One reason that the newest radios perform better is that they are capable of using multiple bands of frequency. For example, a typical radio might be able to use spectrum bands including 2.4 GHz, 3.65 GHz, and 5.0 GHz. This allows better performance for several reasons. First, each frequency band has different operating characteristics in terms of distance and ability to penetrate obstacles. Having multiple frequencies available means an increased opportunity to find a good solution for each customer on the network. But probably even more importantly, the best radios can bond together multiple frequencies to the same customer. This means that they can get the full bandwidth capacity of multiple frequencies added together

into one broadband connection. This is why the new technology can deliver speeds up to 100 Mbps in some situations.

- **Adequate Backhaul**. A wireless broadband network has two major network components - the wireless connection to customers (last mile) and the backhaul connection that brings bandwidth to the radios on the tower. Customer broadband speeds are diminished if a tower doesn't receive enough bandwidth – this is the primary reason why many WISPs offer speeds under 5 Mbps.

- **Terrain/Topology**. Even when a tower gets great bandwidth, there can be obstacles in the wireless last mile that can limit customer bandwidth. Most of these technologies require a line of sight, meaning that there has to be a clear unimpeded visual path between the tower and the customer. Customers that live in valleys or behind hills might not be able to get service. If the signal has to pass through trees or other obstacles the strength of the signal is diminished. The signal can also degrade with rain or snow storms blocking some of the signal. The classic anecdote from wireless technicians is from a slow broadband connection caused by a pigeon or crow sitting in front of a customer antenna dish.

DSL and Copper Technology

In the county any telco not using fiber, such as CenturyLink and Frontier, are using DSL (Digital Subscriber Line) to deliver broadband. DSL works by using the higher frequencies that are available on a piece of copper wire. These frequencies are not used for voice service. DSL is used to provide an Ethernet data path over the copper that can be used to deliver customer broadband service. There are different kinds of DSL standards, each of which has a different characteristic in terms of how much bandwidth they deliver and how far the signal will travel. The most important characteristic of DSL is that customer data speed decreases with the distance the signal travels.

The general rule of thumb is that DSL can deliver a decent amount of bandwidth for about 2 to 2.5 miles over copper. The vast majority of people in the rural areas of the county are more than 2 miles from a town; they are thus able to get only very weak and slow DSL if they're able to get any DSL at all. The large telcos will sometimes sell DSL with speeds as slow as 124 kbps, or just barely faster than dial-up.

DSL signal strength is also affected by the quality of the copper. The newer the copper and the larger the gauge of the copper wires, the better the signal and the greater the bandwidth. Most of the copper wires in the county are likely to be 50 – 70 years old or even older and have outlived their original expected service life.

Hybrid Fiber Coaxial Network

There are two companies that operate Hybrid Fiber Coaxial (HFC) networks in the county – Comcast and Mediacom. Hybrid refers to the fact that an HFC network uses both a fiber backbone network and a copper network of coaxial cable to deliver service. HFC networks are considered lean fiber networks (meaning relatively few fiber strands) since the fiber is only used to deliver bandwidth between the headend core and neighborhood nodes. At each node is a broadband optical receiver that accepts the fiber signal from the headend and converts it into a signal that is sent over coaxial cable to reach homes and businesses.

An HFC system handles delivery of customer services differently than an all-fiber network. For example, in an HFC network, all of the cable television channels are sent to every customer and various techniques are then used to block the channels a given customer doesn't subscribe to.

In an HFC network all of the customers in a given node share the data available to that node. This means that the numbers of customers sharing a node is a significant factor—the smaller the node the stronger and more reliable the data product. Before cable systems offered data services they often had over 1,000 customers on a node. But today the sizes of the nodes have been "split" by building fibers deeper into neighborhoods so that fewer homes share the data pipe for each node. It is this node-sharing that has always given a cable network the reputation that data speeds will slow down during peak usage times, like evenings. If nodes are made small enough then this slowdown does not necessarily have to occur.

The amount of data that is available at a given node is a function of how many "channels" of data the cable company has dedicated to data services. Historically a cable network was used only for television service, but in order to provide data services the cable company had to find ways to create empty channel slots that no longer carry programming. Most cable systems have undergone a digital conversion, done for the purpose of freeing up channel slots.

The technology that allows data to be delivered over an HFC system follows a standard called DOCSIS (Data Over Cable Interface Specification) that was created by CableLabs. The cable networks in the county have used the DOCSIS 3.0 standard that allows them to bond together enough channels to create data products as fast as about 250 Mbps download. However, there is now a new standard, DOCSIS 3.1, that theoretically allows all of the channels on the network to be used for data and which could produce speeds as fast as 8–10 Gbps if a network carried only data and had zero television channels.

The one big data limitation of a DOCSIS network is that the standard does not anticipate symmetrical data speeds, meaning that download speeds are generally much faster than the upload speeds. This is not an issue for most customers, but it does give a fiber network a marketing advantage and there are customers who care about upload speeds. If an HFC network wanted to offer gigabit upload speeds they would need to dedicate an additional 24 empty channels just for the upload, something nobody is ever likely to do.

There is a distance limitation on coaxial cable, but since these networks are not often built in rural areas this rarely comes into play. Unamplified signals are not generally transmitted more than about 2.5 miles over a coaxial network. This limitation is based mainly on the number of amplifiers needed on a single coax distribution route. Amplifiers are always needed for coax distribution over a couple of thousand feet. Modern cable companies try to limit the number of cascaded amplifiers on a coax route to 5 or less. They will want fewer amplifiers if they are trying to deliver top data speeds. As more amplifiers are added the data speeds drop, and so HFC networks are not a great technology for extending broadband into rural areas.

Improved Satellite Technology?

There are several companies that are looking for the funding to build a newer satellite network using satellites placed in orbits much closer to the earth than the current satellites providing broadband. This would solve the latency issue discussed above. The biggest company looking at this is Elon Musk. He

already owns SpaceX, the company that is commercially launching satellites. Musk says it will require a $10 billion investment to build the satellite network. The company launched two test satellites in 2018.,

The satellites would use frequencies between 10GHz and 30GHz, in the Ku and Ka bands. Musk says that SpaceX is designing every component from the satellites to earth gateways and customer receivers. The specifications say that the network could produce gigabit links to customers, although that would require making simultaneous connections from several satellites to one single customer. And while each satellite has a lot of capacity, using them to provide gigabit links would chew up the available bandwidth in a hurry and would mean serving far fewer customers. It's more likely that the network will be used to provide speeds like 50 Mbps to 100 Mbps.

Those speeds could be revolutionary for rural America. The FCC and their CAF II program is currently spending $9 billion to bring faster DSL or cellular service to rural America with speeds that must be at least 10/1 Mbps. Musk says this whole venture will cost about $10 billion and could bring faster Internet not only to the US, but to the world. Still, at this point there is no way to guess if this will ever happen or if the satellites will operate as claimed.

III. FINANCIAL BUSINESS PLAN ANALYSIS

The goal of the financial analysis was to see if there is a way to profitably extend fiber to the rural parts of the county.

A. Business Plan Key Assumptions

This section of the report looks at the detailed assumptions that were made in creating the financial business plans. The business plans created are detailed and contemplate all aspects of operating a broadband network in the county. The business plan assumptions used in the forecast include our best estimate of the operating characteristics for such a business. As a firm, CCG consults to hundreds of communications entities that operate triple-play businesses. We not only work with clients to develop original business plans, but we work with them to help maximize profits with existing businesses. This has given us a lot of insight into how triple play businesses work and we are experienced in how businesses really operate under all sorts of conditions. We believe that the financial results shown in these models are characteristic of similar operations elsewhere and we believe our assumptions are realistic.

The primary goal for these business plans was to determine the breakeven scenario. This tells us the minimum number of customers needed for a given scenario to pay for itself. Breakeven is defined as a business plan with the minimum number of customers where the operating revenues always cover the full costs of operating the business—that means operating expenses, debt payments, and ongoing future capital requirements needed for growth and maintenance.

Following are some of the key assumptions that were used in all of the scenarios studied:

Incremental Analysis

It's important to note that all of the projections were done on an incremental basis. This means that the studies only consider new revenues, new expenses, and new expected capital costs. This is the most common way that businesses of all sorts look at potential new ventures since the incremental analysis answers the question of whether any business line will be able to generate enough revenue to cover the full cost of entering the new market.

It's important to understand what an incremental analysis shows and does not show. An incremental analysis is basically a cash flow analysis. It looks at the money spent to launch and operate a new venture and compares those costs to the revenues that might be generated from the venture.

An incremental analysis is not the same as a prediction of what the accounting books of the new venture might look like. For example, if one of the existing telcos in the area was to undertake one of these business plans, they would allocate some of their existing overhead costs to the new venture. The classic textbook example of this is that some of the existing cost of the general manager of the telco would be allocated to the venture in the accounting books. However, the cost of the salary of the general manager is not considered in an incremental analysis. That salary is already being paid by the existing business. If these studies were to show an allocation of the general manager, then they would not be properly showing the net impact to the telco of entering the new market since the allocation of this expense would improve the financial performance of the existing business and would then not be considered when looking at the new venture.

Timing

Timing is critical to any business plan. The faster that a business can start generating revenues the sooner it can cover costs. These studies are somewhat conservative in the predictions of the speed of the roll-out of the business venture. That means that a service provider can do better than these plans by taking steps to launch the new business faster than what is shown in these projections.

Following are the major milestones as predicted by these forecasts:

- Financing: All of the forecasts assume that the financing is available in January 2020. This is illustrative only and basically establishes a starting date for the project—this could be changed to any other future date as needed.
- Construction: Core construction of the network is done during the spring and summer after financing. That doesn't mean that all of the construction needs to be finished by then and some of the rural construction can be completed in the second year.

Revenue Assumptions

It has been our experience in recent years that new broadband businesses in rural markets do not need to offer low prices to get customers. Faster broadband and good customer service are the keys to success for areas that have not had adequate broadband before. Thus, for purposes of the study we tried to set broadband prices at market rates, meaning the rates that are being charged in the county today for faster broadband. In highly competitive markets it's sometimes necessary for a new competitor to lower rates to

get customers. But in this market, particularly in the rural parts of the county, the goal should be to deliver a quality product at a fair price and not try to gain market share with big discounts.

As was described earlier, there are a number of existing telephone companies already operating in the county. We considered the rates of the telephone companies as well as the broadband offered by the cable companies. We roughly used the rates offered today by Woodstock Communications. We thought those rates were representative of the rates charged in the region for rural customers.

In the all-fiber scenario, we assumed the delivery of the normal triple play of video, voice, and high-speed data. We also assumed that the products would be as simple as possible. As an example, the incumbent telephone companies in the county offer a wide range of different kinds of telephone products. We assumed that a new business would offer only a few options. For instance, for residential service we have assumed only a basic telephone line and a telephone line with unlimited long distance.

Telephone Rates

Our study used the following very simplified pricing for residential phone service:

Basic Local Line	$25.00
Line with Unlimited Long Distance	$37.00

We've assumed that both kinds of lines include a full package of features like voice mail, caller ID, etc. The above prices also include any extra fees that the incumbent telcos show separately on the bill, but which are part of the rate. These rates would not include true taxes on the service.

Our assumption in the study is that the basic line would have the same limited local calling scopes that exist in the county today, as described below. This shows that the amount of free calling varies widely across the county with customers in some parts of the county having free calling to a huge area including the Twin Cities, while other parts of the county have almost no free calling available.

Exchange	Phone Company	Can Call for Free
Belle Plaine	Frontier	Twin Cities
Elysian	Frontier	Waterville
Kilkenny	Frontier	Big Lake, Cambridge, Cokata, Enfield, Hastings, Henderson, Howard Lake, Le Center, Le Sueur, Lindstrom, Lonsdale, Maple Lake, Montgomery, Monticello, Montwave, New Prague, North Branch, Northfield, Norwood, Princeton, Scandia Marine, St. Croix Beach, Stillwater, Taylors Falls, Twin Cities, Waterville, Winsted, Zimmerman

Le Center	Frontier	Big Lake, Cambridge, Cokata, Enfield, Hastings, Henderson, Howard Lake, Kilkenny, Le Sueur, Lindstrom, Lonsdale, Maple Lake, Montgomery, Monticello, Montwave, New Prague, North Branch, Northfield, Norwood, Princeton, Scandia Marine, St. Croix Beach, Stillwater, Taylors Falls, Twin Cities, Waterville, Winsted, Zimmerman
Le Sueur	CenturyLink	Big Lake, Cambridge, Cokata, Enfield, Hastings, Henderson, Howard Lake, Killkenny, Le Center, Lindstrom, Lonsdale, Maple Lake, Montgomery, Monticello, Montwave, New Prague, North Branch, Northfield, Norwood, Princeton, Scandia Marine, St. Croix Beach, Stillwater, Twin Cities, Taylors Falls, Waterville, Winsted, Zimmerman
Lonsdale	Lonsdale Tel	Big Lake, Cambridge, Cokata, Enfield, Hastings, Henderson, Howard Lake, Killkenny, Le Center, Le Sueur, Lindstrom, Maple Lake, Montgomery, Monticello, Montwave, New Prague, North Branch, Northfield, Norwood, Princeton, Scandia Marine, St. Croix Beach, Stillwater, Twin Cities, Taylors Falls, Waterville, Winsted, Zimmerman
Madison Lake	Consolidated	Amboy, Cambria, Eagle Lake, Garden City, Good Thunder, Lake Crystal, Mankato, Mapleton, Nicollet, Pemberton, St. Clair, St. Peter, Vernon Center
Mankato	Consolidated	Amboy, Cambria, Eagle Lake, Garden City, Good Thunder, Lake Crystal, Madison Lake, Mapleton, Nicollet, Pemberton, St. Clair, St. Peter, Vernon Center
Montgomery	Frontier	Big Lake, Cambridge, Cokata, Enfield, Hastings, Henderson, Howard Lake, Killkenny, Le Center, Le Sueur, Lindstrom,

		Lonsdale, Maple Lake, Monticello, Montwave, New Prague, North Branch, Northfield, Norwood, Princeton, Scandia Marine, St. Croix Beach, Stillwater, Twin Cities, Taylors Falls, Waterville, Winsted, Zimmerman
New Prague	Bevcomm	Big Lake, Cambridge, Cokata, Enfield, Hastings, Henderson, Howard Lake, Killkenny, Le Center, Le Sueur, Lindstrom, Lonsdale, Maple Lake, Monticello, Montgomery, Montwave, North Branch, Northfield, Norwood, Princeton, Scandia Marine, St. Croix Beach, Stillwater, Twin Cities, Taylors Falls, Waterville, Winsted, Zimmerman
St Peter	CenturyLink	Mankato
Waterville	Frontier	Elysian, Kilkenny

Customers buying the unlimited long-distance plan would be able to call anywhere in the country, including all parts of the county, as part of their plan. Such plans today often include Canada and even some other international locations.

The study is less specific with business phone rates. In the models we have assumed a monthly telephone revenue per business of $50 per business customer.

Cable TV Products

Offering competitive cable TV in a new rural market is a challenge. In the rural areas today every existing TV customer is using satellite. This means there is already a lot of competition for cable.

Today it’s nearly impossible for a small ISP to compete on price with the satellite providers and landline prices. Small companies that offer TV generally have prices that are significantly higher than satellite prices.

We have elected to not include cable TV in the base study. We find that companies generally have nearly no margin on the product or might even be losing money.

Broadband Products

Our study does not specify data speeds, but we assume that broadband over fiber will be far faster than any broadband available today in the rural areas. We have shown data speeds by 3 tiers. A typical mix of products in three tiers might be 100 Mbps, 250 Mbps, and 1 Gbps.

Residential Fiber Broadband	Price	Percentage
Tier 1	$ 60.00	75%
Tier 2	$ 75.00	20%
Tier 3	$ 90.00	5%
Business Fiber Broadband		
Tier 1	$ 80.00	60%
Tier 2	$ 95.00	30%
Tier 3	$110.00	10%

Most ISPs charge more to businesses for broadband, and we've elected a $20 additive to business rates

It's been the experience of the industry that customers will buy the lowest speed product they are comfortable with in order to save money. The table above shows the assumptions about the percentage of customers who will buy each product.

These are shared data products, meaning that the overall bandwidth to provide them is shared among multiple customers. This is not to say that the data path to a given customer is not secure, because the transmission to any specific customer is encoded for privacy purposes. Still, there might be some business customers that will want a dedicated data product that is not shared with anyone else. The network can accommodate this by providing such customers with an active ethernet connection. Prices for these services would cost a lot more than shared data services. It would be surprising if there are any businesses in the rural parts of the county that would ask for dedicated broadband.

The financial models assume that the data products don't have data caps and provide unlimited broadband usage to customers. If there were data caps, then customers that exceeded those caps would be charged more than the basic prices. Very few small service providers impose data caps. There are data caps on CenturyLink DSL, but it's been widely reported that the company often doesn't bill for data overages.

Customer Penetration Rates

One of the most important variables in the study is the customer penetration rate, or the percentage of the homes and businesses in the community that will buy service.

In our analysis we looked at customer penetration rates in several different ways. We started the analysis using what we call expected rates. We used an expected penetration rate of 70% as the starting point of our analysis. This is not to say that we are predicting that a broadband business would do that well in these areas. We have witnessed the construction of broadband in a number of rural markets in the last few years and we have seen customer penetration rates in those markets range between 60% and 85%, with a few even higher. We arbitrarily chose 70% as something that we think is reasonably conservative.

We also calculated what we call the breakeven penetration rate. This calculates the number of customers that are needed for a project to reach cash breakeven – where the business would always be able to pay for operating expenses, debt, and the ongoing capital needed.

It's difficult to predict how well fiber might be accepted in the rural parts of the county. Some percentage of households are likely to be happy with the faster wireless products that are in the county or that are coming soon.

The only real way to understand the potential broadband penetration rate would be to do a residential survey or a canvass and quantify the potential customer interest in the service area in buying broadband from a new network. We have found that surveys are a great tool for understanding customer interest and are a good way to predict future customers. They are not perfect, but more often not we see actual interest in a new network closely mirror what was predicted by a survey.

Managed WiFi

This is a relatively new product that's been around for a few years. ISPs have found that one of the biggest problems with home broadband is from using obsolete or poorly placed WiFi routers in the home. A poor WiFi router means a poor broadband product.

Many ISPs are now offering managed WiFi. This involves the ISP providing a carrier-class WiFi router and the ISP also placing it a product where the service provider helps to improve the WiFi system in homes by placing networked WiFi routers, and then also making it easier in the future to add devices to the WiFi network. ISPs can also help customers connect new devices to the wireless network. There is a network advantage to the product because it provides a monitoring location inside the home, meaning that the ISP is more easily able to point problems.

In the study we assumed a monthly residential rate of $7.50 and $10.00 for businesses.

Other Future Revenues

The forecasts also suppose that the new ISP will generate additional revenue over time from business lines that are not specifically identified in the projections. Already today we see small ISPs offering

- Security: This is burglar alarms, motion detectors, smoke and CO2 detectors, and other devices to create a home security suite.
- Home Automation: We see companies now offering the service of connecting Internet of Things devices. This might include surveillance cameras, smart thermostats, smart lighting, watering systems, smart door locks, and other devices that automate the home or office.

The business plan is not specific about which future products might be introduced and in fact it could be products that we don't even envision today. Since we can't know the specific products the forecasts include the net margin—the cash profits—from these future revenue sources rather than trying to predict both the revenue and expenses. The forecasts also add this slowly. For

example, the forecasts predict that there will be new products of some sort sold to only 3% of customers by 2020 with an average margin for those few customers at $10 per month. This doesn't add a lot of bottom line to the model, but we are certain that over time all small ISPs will offer services that are not included in the base forecasts.

Single Provider Model

The following assumptions are for a single-provider model, meaning that the same entity owns the network and operates the business. The operator in this case would mostly likely be the county, although this same projection would suffice for any other small ISP that launched this business. Later in this section we look at a model where the county owns the network but a partner operates it.

Expense Assumptions

Expenses are the recurring costs of operating the business once it's built. We strive when building financial projections to be conservatively high with expense estimates. It's often less costly for an existing service provider to add a new market than what is shown in these projections. For example, if we predict the new business might need to hire additional staff for customer service or for field technicians, we often find that existing staff at service providers are able to pick up much of the new work load without having to hire more employees.

We made the following assumptions about expenses:

Employees: Labor is generally one of the largest expenses of operating a broadband network. Our models assume that a service provider will need to hire additional staff to take care of the added customers. We have assumed salaries at market rates with an annual 2.5% inflation increase for all positions. We've assumed that the benefit loading is 32% of the basic annual salary. That would cover payroll taxes and other taxes like workers' compensation, as well as employee benefits.

As stated earlier, these models are incremental and only consider the additional labor needed because of the customers added. At a minimum, the new business would require the following two additional types of employees:

Customer Service Representative: Takes new orders, answers customer questions about billing, services, etc. We've assumed the business will require 2 new positions for the various scenarios.

Install/Repair Technician: This function installs new customers and visits customers for needed maintenance and repairs. We've assumed the business will need 2 new positions for the various scenarios.

There are obviously other functions that must be done in a new business. For example, a service provider must have a general manager. There will generally be an accountant or bookkeeper of some sort. There might be intermediate management in charge of the technicians or customer service representatives. There might be full-time marketing people. But as described above, this

analysis would not show these functions unless it was necessary to hire new employees due to adding the new market.

We anticipated that construction contractors will build the fiber network. We've also assumed that the installations at the customer site would be outsourced during the construction process and for the first few years thereafter. However, once the bulk of customers has been added the forecasts assume that future installations will be done by company technicians.

Start-Up Costs: To be conservative, there are some start-up costs included in each scenario. There are expenses associated with launching a new business or new market and rather than list them all specifically we have included them as start-up costs. There are start-up costs even for an existing ISP when entering a new market.

Sales and Marketing Expenses: Every scenario is going to require a significantly high customer penetration rate to be successful. We used the assumption that there would be a marketing effort to sign customers (instead of the word-of-mouth that often happens in rural markets). It would be too risky to spend the money to build a network without knowing for sure that there are enough interested customers to allow the business to pay for itself. Marketing expenses shown in the models are likely going to be for that effort. It's possible that such money would be spent earlier than shown in the model. There have been rural start-ups that have been able to sign up customers using community volunteers, so it's possible that the marketing costs could be lower than shown.

Delivery of Products: The projections assume that the new business will not construct a headend to provide the services. If your partner is already offering these products, then the assumption is that they would deliver the same product to the new customers in the same manner that they deliver to existing customers. If the county or some new provider was to operate the business, it's assumed that they would buy the wholesale services from another service provider.

Maintenance Expenses: There are a number of routine maintenance expenses that the new business would incur on an incremental basis. These include:

- Vehicle expenses to maintain the vehicles required for the field technicians.
- Computer expenses to support the computers used by employees.
- Tools and equipment expenses.
- Power expenses to provide power to the network.
- General maintenance and repair of the outside plant network and the electronics to repair damaged or nonfunctional electronics.
- Internet Backbone. Since this is an incremental analysis we have shown only incremental increases in the cost of internet bandwidth. If this business was served by a new entity then the cost of bandwidth would be higher to also cover the cost of transport to reach the Internet.
- Internet Help Desk. The monthly fee for this service covers several different functions. This fee would cover those functions used to deliver broadband such as spam monitoring and security. This also includes network monitoring. And the fee includes the help desk function, which is the function of assisting customers with broadband and network issues.

Software Maintenance: Triple-play providers maintain a complex software system called BSS/OSS (billing and operational support systems). This software provides a wide range of functions: order taking, provisioning new customers, tracking of customer equipment, tracking of inventory, creation of customer bills, tracking of customer payments (or nonpayment). Since most such software is billed to providers on a per-customer basis we have assumed an expense for this maintenance.

Billing: Billing costs are shown as the incremental cost used to bill customers. We assumed that there would be some mix of mailing paper bills, of charging bills to credit cards, and of charging bills directly as debits to bank accounts.

Taxes: The model assumes that the business that operates the business will pay state and federal income taxes. These taxes would not apply if this was operated as a municipal business or as a nonprofit.

We have assumed no property taxes on assets, but it's possible that some amount of this might apply.

The forecasts do not include any taxes that are assessed to customers. For example, this business would be expected to charge and collect various telephone taxes. These kinds of fees are normally added to the customer bill, and thus customers directly pay these taxes. The models don't show these taxes and the assumption is that the taxes would be collected and sent to the tax authorities on the customers' behalf. They are not shown as revenue or expense to the forecasts, but rather are just a pass-through.

Overhead Expenses: The forecasts include various overhead expenses. Again, since this is an incremental model it does not include allocated expenses such as an allocation of the general manager's salary. But there are incremental costs attributable directly to the new business. This would include things like legal expenses, accounting audit expenses, consulting expenses, business insurance, and other similar expenses that are directly related to entering a new market.

Depreciation and Amortization Expense: The forecasts include both depreciation and amortization expense. These are the expenses recognized by writing off assets over their expected accounting lives. For example, the depreciation rate for a vehicle is 20% per year (is written off over 5 years). The cost of a new vehicle is then depreciated monthly to write off the asset over the 5 years, or 60 months. All hard assets are depreciated except land. Depreciation rates are set according to the expected life of the assets—something that is usually determined to comply with IRS rules and also accounting standard practices. Soft assets like software are instead amortized, using the same process as depreciation.

Why the Projections Are Conservative

We always try to make our business plans conservative. By conservative, we mean that an actual business plan ought to perform a little better than we are projecting. Following are some of the conservative assumptions used in the business plan:

- The models contain no "home run" revenues. These would be sales of larger broadband products such as leasing space on a tower to a cellular company or selling bandwidth to the local schools. We know that every fiber business gets some of this kind of revenue, but we took the conservative approach of not showing it because we can't guess how much and when such opportunities might occur.
- The engineering estimates include a 10% contingency. We think the estimates of construction costs are solid and this contingency might not be needed.
- If the network was constructed by "edging out" from existing telcos, there would be some savings in the cost of building fiber.
- In the model, we show an increase in the cost of wholesale bandwidth over time. However, industry costs for raw data might be less than we are projecting and might even drop over time.
- Our model assumes a regular replacement of electronics. However, it is possible that upgrades will be needed less often than we have shown. Further, our assumption is that the cost of electronics at the time of each upgrade would cost as much as the equipment that is being retired. The experience of the electronics industry is that electronics get cheaper and more efficient over time, so the cost of upgrades is probably going to be less than is shown in the model. The vendors in the industry have also gotten better at having phased upgrades that allow for keeping older equipment in place and not having to replace everything at once, making upgrades less expensive than we have projected.
- There are steps that the new business could take to improve upon these projections.
    - Preselling: We've seen service providers that are able to get earlier revenues when they presell to customers. This gives them the opportunity to begin connecting the network to the homes of presold customers while the network is being built. This would allow customers to be turned on in "nodes" or neighborhood-by-neighborhood as construction to specific parts of the county was completed.
    - More Concentrated Build Schedule: It's always possible to build faster than shown in these forecasts if the service provider insists on a faster construction schedule. Basically, for these kinds of networks, the amount of network that can be built increases by adding more construction crews.
    - Get Temporary Help: There are often other bottlenecks at small companies that can slow down customer installations. This could mean the need for more sales and marketing staff, additional customer service reps, or inside technicians needed to provision new customers. Service providers should strongly consider using temporary employees during the roll-out of a major new market.
    - Evaluate Based Upon Speed to Market: Any given service provider might tackle the business plan in a different sequence than shown in these forecasts.

B. Business Plan Results

It is never easy to summarize the results of complicated business plans to make them understandable to the nonfinancial layperson. In the following summary are some key results of each study scenario that we think best allows a comparison of the numbers between scenarios. We look at the amount of cash generated over the life of the plan as well as at the years when each plan achieves positive net income and debt breakeven. Those two new terms are defined as follows:

Positive Net Income: The year when the business shows a positive profit defined in the normal accounting sense. This uses the taxation and public accounting definition of profitability and includes depreciation and amortization, which are not cash expenses. The net income also does not consider repayment of debt principle and annual operating capital. Reaching positive net income is an important milestone for a new business and is one of the ways that the public will judge your success. Just note, though, that the business can have a positive net income and still not have enough cash to operate the business. But it's even more common for an asset-intensive business like this one for a business to reach positive cash flow but still have a negative net income—due almost entirely to depreciation expense on the network, which is a non-cash expense.

Debt Breakeven: The year when the business has generated enough excess cash that would enable the retirement of the remaining debt. Many loan and bond covenants don't allow excess cash from a business to be used for anything else, like dividends, until the debt has been retired.

The way to measure profitability in a new business is going to differ according to the structure of the business. A municipal business, for example, generally measures success by the ability of the business to generate enough cash to operate without any external subsidy. While for-profit business would generally use something like net income to measure profits.

It is important that a business always have cash in the bank to meet its obligations. In this particular business plan the ideal situation would be to always have at least $400,000 in the bank to have a cushion against nonlinear monthly expenditures. Not all expenditures are spent evenly throughout the year and a business must maintain a cash cushion to allow for those times of the year when the expenses are higher than normal or when the revenues are lower than normal.

Following are the results of the various scenarios. Also note that a table of all of the financial results is included in Exhibit IV. That Exhibit makes it easier to compare different scenarios.

County as the ISP - Bond Financing

This scenario examines the financial viability of the county serving as the ISP. We know that is not the county's preference, but we thought it would be informative to understand how the project might look if it was funding using municipal bonds.

The following results all assume a 70% customer penetration rate and look at the scenario that excludes the rural Bevcomm service area:

	Revenue Bonds[3]	GO Bonds[4]	GO Bonds + $5M Grant
Asset Costs	$16.80 M	$16.80 M	$16.80 M
Grant	$ 0.00 M	$ 0.00 M	$ 5.00 M
Bond Debt	$22.60 M	$20.40 M	$14.40 M
Passings	2,402	2,402	2,402
Penetration Rate	70%	70%	70%
Years until Positive Net Income	Never	Never	Never
Years until Cash Covers Debt	Never	Never	Never
Cash after 20 Years	($17.66 M)	($16.93 M)	($ 9.46 M)

As can be seen, financing with municipal bonds doesn't look feasible. Even with Border-to-Border grants these scenarios lose a lot of money. This is due to two issues:

- Rural Nature of the Study Area: Except for the tiny towns of Cordova, Kilkenny, and Ottowa, the study areas without broadband are truly rural and there aren't any clusters of homes that would lower the cost of construction on a per customer basis. In this particular scenario the cost of total assets required per passing is $6,994. If we assume a 70% take rate, the cost per actual customer is $9,992. To put this into perspective, we recently finished a feasibility study for a town with about 7,500 homes that had roughly the same network cost. In a town of that size the cost per passing would be around $2,250 and the cost per customer would be $3,200. It's difficult to be profitable in a rural area because of the network cost.
- Economy-of-Scale: The broadband business is an economy of scale business. This means that the business gets more efficient as the business gets larger. This is easy to understand. Consider, for example, the cost of keeping the books for the business – the accounting function. Let's assume this cost is $10,000 and would be roughly the same if the business had 1,000 customers or 5,000 customers. The cost per customer with 1,000 customers is $10 per customer while the cost for the same function with 5,000 customers is only $2 per customer. That is called the economy-of-scale savings and the profit margin per customer is significantly higher as a business of this type gets more customers.

  All of the scenarios we studied in the county have between 2,400 and 3,200 passings, meaning between 1,700 and 2,250 customers at a 70% penetration rate. That is a small number when looking at an ISP business. There is a general metric in the industry that an ISP starts reaching maximum efficiency somewhere between 75,000 and 100,000 customers. There comes a point when businesses get too large, like with the giant cable companies, where businesses get less efficient.
- Cost of Bond Financing: While bond financing can have a relatively low interest rate it can still be significantly more expensive than traditional bank financing. Consider the following summaries of the cost components of the three bonds listed above:

[3] Revenue bonds are bonds that are guaranteed by the revenues of the project. In this case, that would mean the revenues generated by sales of services on the fiber network.

[4] GO Bonds = general obligation bonds. These are bonds that are guaranteed by tax revenues should the project not generate enough revenue to make bond payments. In such a cash the county might increase property taxes, sales taxes or some other levy to make the bond payments.

	Revenue Bonds	GO Bonds	GO Bonds + $5M Grant
Asset Costs	$16.80 M	$16.80 M	$16.80 M
Working Cash	$ 1.13 M	$ 1.02 M	$ 0.72 M
Debt Service Reserve Fund	$ 1.52 M	$ 0.00 M	$ 0.00 M
Capitalized Interest	$ 2.71 M	$ 2.14 M	$ 1.51 M
Cost of Issuance	$ 0.39 M	$ 0.36 M	$ 0.29 M
Rounding	$ 0.04 M	$ 0.08 M	$ 0.08 M
Cost of the bond:	$22.60 M	$20.40 M	$14.40 M
Grant	$ 0.00 M	$ 0.00 M	$ 5.00 M
Total Financing	$22.60 M	$20.40 M	$19.40 M

As can be seen, you have to borrow a lot more money with a bond than the cost of the assets. Below is a description of these various costs:

- Working Cash. Since bonds are all borrowed up-front at the beginning of a project, the working cash is to cover expenses that are incurred until the project creates enough revenues to cover expenses.
- Debt Service Reserve Fund (DSRF). Revenue bonds are considered riskier than general obligation bonds, and so bond sellers often require the bonds to include a DSRF equal to 1 year's worth of bond payments as a safety net in case the county had trouble making the bond payments.
- Capitalized Interest. Bondholders begin earning interest as soon as the bonds are generated. In this case we've assumed that the interest payments for the first 3 years are borrowed, giving the fiber business time to become successful before it has to generate cash to cover bond payments.
- Cost of Issuance. There is a significant cost incurred to issue bonds that includes attorneys, consultants, and fees for the companies that sell the bonds.

As will be demonstrated below, the amount of debt required for traditional bank financing is far smaller than with municipal bonds.

In this case, because of the various cost-related issues discussed above, the project does not generate enough cash to cover operating expenses plus bond payments. This results in significant operating losses that would continue until the bond was retired.

Since the county would prefer to not be an ISP, and because it looks like all scenarios funded with bonds will lose money, we didn't look at any scenarios beyond these three examples. Even with a full $5 million Border-to-Border grant the losses are significant using bond financing.

These results also mean that it's going to be nearly impossible to consider a public-private partnership where the county builds the network and some other entity operates it.

Commercial ISP – Traditional Bank Financing

The county's hope is that you will be able to lure a commercial ISP to extend fiber throughout the rural parts of the county. The remaining scenarios consider the ability of a commercial ISP to create a viable

business plan in the rural parts of the county. As discussed at other places in the report, we studied four different scenarios:

	Passings
Unserved Areas excluding Bevcomm	2,402
Unserved Areas including Bevcomm	2,539
Areas without 100/20 Mbps excluding Bevcomm	2,954
Areas without 100/20 Mbps including Bevcomm	3,233

Scenarios Excluding Bevcomm

It seems likely that Bevcomm will eventually build fiber in their telephone territory, so these are probably the most important scenarios to consider.

Following are the results of the financial analysis for the business without Bevcomm.

	Unserved Areas	< 100 Mbps Areas
Asset Costs	$16.58 M	$17.85 M
Grant	$ 0.00 M	$ 0.00 M
Equity	$ 3.78 M	$ 4.01 M
Bank Debt	$15.13 M	$16.03 M
Total Financing	$18.91 M	$20.03 M
Passings	2,402	2,954
Penetration Rate	70%	70%
Years until Positive Net Income	Year 20	Year 16
Years until Cash Covers Debt	Never	Never
Cash after 20 Years	($10.50 M)	($6.69 M)

What do these results tell us?

- Here are the key assumptions included in these scenarios:
  - Fiber built to pass every home and business in the serving areas.
  - This assumes that somebody other than the county is the ISP and the owner of the network.
  - This is financed with traditional bank loans that require 20% of the project to be funded with equity. That would mean that whoever builds this will need to bring roughly $4 million in cash to the project in order to secure the loan.
  - The loans have a 20-year term and assume a 5.5% interest rate. We assume that there would be no principle payments required for the first 2 years.
  - We've assumed a 70% customer penetration rate, which would be typical of the kind of performance one would expect in rural areas that don't already have fast broadband. There will more discussion of penetration rates below. It would be possible for the business to perform better than this – something that is explored below.

- Both scenarios lose money over time and a detailed investigation of the projections show that revenues are not sufficient to cover cash outlays, which are operating expenses, debt payments, and ongoing capital costs.
- It's obvious in looking at the results that grant financing is going to be required as part of any funding solution.
- The results also demonstrate the economy-of-scale savings, and the scenario with 2,954 customers performs better than the scenario with fewer customers.
- This also shows that a commercial ISP partner is going to have to bring equity to any venture to build fiber in the county. While municipalities can borrow 100% of the cost of a project using municipal bonds, commercial banks expect a borrow to have some "skin in the game." The amount of equity required for the various scenarios is between $3M and $4M. That is not an insubstantial amount of cash and prospective partners might have issues with contributing that much money to this project. This, perhaps more than anything, demonstrates the issues and concerns of an ISP to build fiber in a rural area. They have to contribute a significant amount of their own cash at the beginning of a project with no guarantee of ever earning a profit.

Sensitivity Analysis

While each of the financial forecasts is based upon numerous assumptions, only a few of the assumptions have the potential to significantly change the results of the analysis. For example, the results of the studies would change only slightly by changing the assumed salary of one of the new employees. But the study results would change more significantly if changing the interest rates on debt financing.

The following sensitivity analysis looks at the impact of changing those assumptions that can most affect the results.

The sensitivity analysis specifically tested the following variables:

- Changing the customer penetration rate.
- Changing the interest rate on debt.
- Changing customer data prices by $5 per customer per month.
- Eliminating the construction contingency, which looks at the impact of being able to build the network for less than the estimate made by Finley Engineering.
- We look at the impact of adding $1 million and $5 million of grant financing to the project.
- Finally, we took a look at what we are calling the most optimistic look – how much better could the results be if several of the major assumptions were conservative.

Following are the sensitivity results considering the scenario above that builds fiber to all with broadband less than 100/20 Mbps and which excludes Bevcomm. Note, however, that the sensitivity analysis was performed for all four scenarios and the results are included in Exhibit IV. Following are the results of the sensitivity analysis, with each change compared to the base study shown above.

Changing Customer Penetration Rate: The following shows the impact of increasing the customer penetration rate from 70% to 80%.

Effect of this Change	Base Case	Revised
Asset Costs	$17.85 M	$18.42 M
Grant	$ 0.00 M	$ 0.00 M
Equity	$ 4.01 M	$ 4.08 M
Bank Debt	$16.03 M	$16.30 M
Total Financing	$20.03 M	$20.38 M
Passings	2,954	2,954
Penetration Rate	70%	80%
Years until Positive Net Income	Year 16	Year 11
Years until Cash Covers Debt	Never	Never
Cash after 20 Years	($6.69 M)	($3.15 M)

As would be expected, adding customers increases the needed capital (cost of the electronics and drops needed to add them to the network), and this increases the needed amount of financing.

The bottom-line impact to cash is an increase in cash flow over 20 years of $3.54 million. This impact is somewhat linear, and the same magnitude impact would be expected if the business instead achieved less than a 70% customer penetration.

Paying a Higher Interest Rate: This looks at the impact of increasing the interest rate by 100 basis points from 5.5% to 6.5%.

Effect of this Change	Base Case	Revised
Asset Costs	$17.85 M	$17.85 M
Grant	$ 0.00 M	$ 0.00 M
Equity	$ 4.01 M	$ 4.03 M
Bank Debt	$16.03 M	$16.13 M
Total Financing	$20.03 M	$20.16 M
Passings	2,954	2,954
Penetration Rate	70%	70%
Years until Positive Net Income	Year 16	Year 16
Years until Cash Covers Debt	Never	Never
Cash after 20 Years	($6.69 M)	($7.80 M)

As would be expected, a higher interest rate reduces long-term cash flow. In this case, increasing the interest rate by a full percentage (100 basis points) lowers the cash generated over 20 years by $1.1 million.

Increasing Customer Prices: In this scenario, the broadband prices are increased by $5 per month for both residents and businesses.

Effect of this Change

	Base Case	Revised
Asset Costs	$17.85 M	$17.85 M
Grant	$ 0.00 M	$ 0.00 M
Equity	$ 4.01 M	$ 3.98 M
Bank Debt	$16.03 M	$15.90 M
Total Financing	$20.03 M	$19.88 M
Passings	2,954	2,954
Penetration Rate	70%	70%
Years until Positive Net Income	Year 16	Year 13
Years until Cash Covers Debt	Never	Never
Cash after 20 Years	($6.69 M)	($4.41 M)

This shows that the business is sensitive to prices. In this case, increasing the price of the broadband products by $5 increases the cash by almost $2.3 million over 20 years.

This raises the question of the right pricing for broadband. In order for the broadband product to be competitive it has to be reasonably priced below the competition. However, if broadband is underpriced it drives a lot of cash from the performance.

Today the fastest broadband products in the rural parts of the county are fixed wireless. The fastest products from those competitors range from $70 to $100 per month for speeds that range from 25 Mbps to 30 Mbps.

The base analysis for this study set the base broadband price at $60 per month for 100 Mbps symmetrical on fiber. It would not be unreasonable to set the base price at $65 based upon the market rate – and as this analysis shows that would add a lot of cash to every scenario being considered.

Eliminating the Construction Contingency: This examines the impact of decreasing capital expenditures. Specifically, this shows the impact of not having to spend the construction contingency, which is approximately $1 million. But the impact would be identical for reducing capital by that same amount for any other reason.

Effect of this Change	Base Case	Revised
Asset Costs	$17.85 M	$16.81 M
Grant	$ 0.00 M	$ 0.00 M
Equity	$ 4.01 M	$ 3.77 M
Bank Debt	$16.03 M	$15.08 M
Total Financing	$20.03 M	$18.84 M
Passings	2,954	2,954
Penetration Rate	70%	70%
Years until Positive Net Income	Year 16	Year 13
Years until Cash Covers Debt	Never	Never
Cash after 20 Years	($6.69 M)	($5.23 M)

This shows that lowering capital expenditures by $1 million improves the cash flow over 20 years $1.46 million. That impact represents the savings in interest expense due to lowering the amount of debt.

Impact of $1 Million of Grants: This examines the impact of receiving a $1 million grant to help pay for the network.

Effect of this Change	Base Case	Revised
Asset Costs	$17.85 M	$16.81 M
Grant	$ 0.00 M	$ 1.00 M
Equity	$ 4.01 M	$ 3.78 M
Bank Debt	$16.03 M	$15.10 M
Total Financing	$20.03 M	$19.88 M
Passings	2,954	2,954
Penetration Rate	70%	70%
Years until Positive Net Income	Year 16	Year 13
Years until Cash Covers Debt	Never	Never
Cash after 20 Years	($6.69 M)	($5.30 M)

This shows that receiving a $1 million grant improves cash flow by lowering capital expenditures by $1 million improves the cash flow over 20 years by $1.39 million. That impact represents the savings in interest expense due to lowering the amount of debt.

Our forecasts include a construction contingency in order to be conservative. It’s possible that a contingency would not be needed. Further, there are other conservative assumptions in the capital

costs and other opportunities to save on capital expenditures for assets like the fiber drops to customers.

Impact of $5 Million of Grants: This examines the impact of receiving $5 million in grants to help pay for the network. That's the maximum that would be available from the Minnesota Border-to-Border grant program.

Effect of this Change

	Base Case	Revised
Asset Costs	$17.85 M	$16.81 M
Grant	$ 0.00 M	$ 5.00 M
Equity	$ 4.01 M	$ 2.88 M
Bank Debt	$16.03 M	$11.53 M
Total Financing	$20.03 M	$19.41 M
Passings	2,954	2,954
Penetration Rate	70%	70%
Years until Positive Net Income	Year 16	Year 11
Years until Cash Covers Debt	Never	Year 20
Cash after 20 Years	($6.69 M)	$0.11 M

This shows that $5 million in grants brings the project to a cash breakeven over 20 years – with a 70% customer penetration.

Optimistic Case: This scenario combines several of the improvements examined above to show how the various incremental changes are additive. This scenario considers the following:

- Increase broadband rates by $5 per month.
- Reducing capital by $1 million
- Receiving the $5M Border-to-Border Grant
- Increases customer penetration to 75%

Effect of this Change

	Base Case	Revised
Asset Costs	$17.85 M	$17.04 M
Grant	$ 0.00 M	$ 5.00 M
Equity	$ 4.01 M	$ 2.64 M
Bank Debt	$16.03 M	$10.70 M
Total Financing	$20.03 M	$18.34 M
Passings	2,954	2,954
Penetration Rate	70%	70%
Years until Positive Net Income	Year 16	Year 11

Years until Cash Covers Debt	Never	Year 20
Cash after 20 Years	($6.69 M)	$5.65 M

This is a reasonably realistic scenario. There are other improvements that might also occur, such as obtaining a lower interest rate on debt. The main purpose of this scenario is to demonstrate that there are scenarios of the business plan that produce positive cash and which might be attractive to a partner.

What Conclusions Can We Draw from the Financial Results?

There are a number of conclusions we can draw from the results of the business plan analysis:

Economy of Scale. The results demonstrate a clear economy-of-scale advantage for the business. The results for providing broadband to all rural households (2,954 homes) performed significantly better than providing broadband only to those homes that don't have 25/3 Mbps service available today (2,402 homes).

Requires Grant Funding. It is hard to find a scenario that can succeed without getting grant funding. We looked at scenarios that considered $5 million in grant funding – the most available from the Minnesota Border-to-Border grant program. But it doesn't matter if the grants come from a federal or state grant program or from the county.

Hard to Finance with Bonds. We looked at funding the network using municipal bonds. The extra borrowing costs associated with bonds, such as capitalized interest, make it difficult to find a scenario that could work with bond financing. Luckily, the county doesn't want to be the operating ISP and won't be the entity funding a network, but this does limit some of the public-private partnership options where the county would fund the network and somebody else would operate it.

Will Require Significant Equity. A commercial ISP that builds and operates the network would need to contribute $3 million to $4 million in equity in most scenarios. This is a significant hurdle that many telcos and other ISPs will find hard to meet. Banks sometimes will consider some grant money as equity and might lower the amount of needed cash equity.

The Business is Sensitive to a Few Key Variables. There are a few key variables that have a major impact on the long-term performance of the business. Following are the key variables and their impact:

- Penetration Rate: Increasing customers from 70% to 80% generates an additional $3.54 million over 20 years.
- Broadband Prices: Increasing Residential and Business Broadband rates by $5 per month increases cash over 20 years by $2.28 million.
- Interest Rate: Changing the interest rate by one-half of a percent (50 basis points) changes the cash over 20 years by $1.11 million.
- Lower Network Cost: Shaving $1 million from the cost of construction improves cash over 20 years by $1.46 million.
- $1 Million Grant: Receiving a $1 million grant to help pay for the project increase cash flow over 20 years by $1.39 million.

To some degree, these various impacts can be added together. For example, we considered a scenario that increases broadband prices by $5 per month, reduced the cost of the network by $1 million, attracted a $5 million Border-to-Border grant, and increased customer penetration rates to 75%. These improvements increase cash flow over 20 years by $12.34 million over the base case – and turned it into a scenario that makes money.

It is essential before deciding to get into the business to pin down these key variables. This means that you can't take the financial results listed above or in Exhibit IV as the straight answer, because these variables can change the result of any financial projection.

C. Financing Considerations

One of the most significant costs of building a broadband network is the financing cost needed to raise the money to pay for the network. In this section of the report we are going to look at all of the various ways that other communities have been able to fund broadband networks. If a community wants fiber badly enough then we've found that there is always a way to pay for it.

There are a number of different financing option to consider. Below we look at the following:

- Public Financing (bonds)
- Private Financing (loans)
- Grants
- Federal Programs
- State Programs
- Customer Financing
- Public Private Partnerships
- Other

Public Financing Options

We know the county is not interested in operating an ISP, but if no other solution surfaces, then the county could finance the project and partner with somebody else to operate the business. It would also be possible for the county to act as the bank for broadband expansion, as was done in Sibley County and in Swift County. For the sake of those options it's worth understanding the difference between public financing and commercial financing.

The two primary mechanisms used for public financing are revenue bonds and general obligation bonds. There are some major benefits of using bond financing. First, the term of the bond can match the expected life of the assets and it is not unusual to find bonds for fiber projects that stretch out for 25 to 30 years. Second, you can finance a project completely with bonds, meaning that no cash or equity needs to be put into the business up front.

> **Revenue Bonds**: The primary historic source of money to finance this sort of telecommunications system is through the issuance of municipal tax-exempt bonds. Most of the municipal fiber networks that have been built have been financed through revenue bonds. Revenue bonds are backed by the revenues and the assets of the fiber network and the associated business. With a pure revenue bond, the county would not be directly responsible for repaying a revenue bond

should the project go into default. With that said, having a default would be a financial black-eye that might make it hard to finance future projects. So, to some degree the county would still be on the hook for the success of the revenue bonds, at least tangentially.

However, it is getting harder to finance a project with revenue bonds due to some failures on the part of other municipal networks. Among these are Monticello, MN; Crawfordsville, IN; and Alameda, CA. These kinds of failures have made investors leery about buying bonds that are only backed by the business. This reluctance has made financing with revenue bonds more expensive.

The cost of a bond issue cannot be judged only by the interest paid. In fact, the other financing costs of bonds can outweigh the interest rate in the effect on the bottom-line cost of repaying a bond issue. Because of market reluctance to buy revenue bonds, they often have higher interest rates than general obligation bonds, but they also can incur the following costs:

Debt Service Reserve Fund (DSRF): Many revenue bonds require borrowing additional funds to be kept in escrow as a hedge against missing future payments. The DSRF is often set to equal a year's worth of principle and interest payments. This money is put into escrow and is not available to operate the business.

Capitalized Interest: Bonds begin accruing interest from the day the money is borrowed. Since fiber businesses take a number of years to generate enough cash to make bond payments, the bondholders require capitalized interest that is used to make the interest payments for up to the first five years of the project. Basically, the project must borrow the amounts needed to make debt payments which can add a significant amount to the size of the bond issue.

Bond Insurance: Bond insurance is an up-front fee paid to an insurance company that will then pay one year of bond payments to bond holders in case of a default. We've seen bonds issued that have required both a debt service reserve fund and bond insurance.

For a number of years now the interest rates charged to bonds have been lower than the interest rate on commercial loans. But that has not always historically been the case. The difference between bond interest rates and commercial interest rates both change over time; that difference is referred to in the industry as the "spread." Sometimes the spread favors bonds and at other times it favors commercial borrowing. In our financial analysis we assumed that the interest rates are lower on bonds. Interest rates are also not the same for all kinds of bonds. For instance, the interest rate for revenue bonds can be considerably higher than general obligation bonds due to the perceived higher risk.

General Obligation Bonds (GO Bonds): If revenue bonds aren't an option, then the next typical alternative is general obligation bonds. General obligation bonds are backed by the tax revenues of the entity issuing the bonds. This backing can be in the form of various government revenues such as sales taxes, property taxes, or the general coffers of a government doing the borrowing.

In Minnesota many kinds of general obligation bonds require a referendum approval by a simple majority of voters. There are some kinds of economic development bonds and other types of GO

bonds that don't require a referendum, although government entities sometimes hold a referendum anyway just to make sure the public supports the initiative being financed.

There are other financing mechanisms that have been used by other municipalities to fund revenue-generating projects. These include:

Variable Rate Demand Obligations (VRDOs): VRDOs are a bond where the principal is paid in a lump sum at maturity. However, the borrower has the right to repay the bonds in whole or in part at any time (upon an agreed-upon notice). VRDOs are effective in circumstances when the borrower wants to match the repayment of the bonds to a revenue stream that varies year to year or a revenue stream that can vary from initial estimates and changes over time. In the case of the new telecommunications system, this type of financing provides the flexibility to make bond payments that match the actual revenues received. If revenues are slower than anticipated, principal payments do not need to be made. If revenues come in faster than anticipated, repayment of the bonds can be accelerated without penalty. We can recall having only ever seen this used once for a municipal telecom system by the city of Alameda, California. This kind of financing is used fairly routinely for other kinds of municipal needs.

VRDOs are most commonly structured as 7-day floating rate bonds. Interest rates are reset each week, and this adds a lot of risk to this type of financing. Unlike fixed-rate bonds, the borrower does not know what the interest rate will be on the VRDOs over the life of the issue. Interest rates on VRDOs are on the short end of the yield curve and have therefore historically been lower than interest rates on fixed-rate bonds even with the additional ongoing costs for a liquidity provider and a remarketing agent. There is typically a maximum rate stated which the VRDOs cannot exceed. But in a market where there is a significant increase in overall interest rates this kind of financing could end up being significantly more expensive.

Capital Appreciation (zero coupon) Bonds (CABs): CABs are bonds that are issued at a deep discount and which do not bear any stated interest rate. Like a Series E savings bond, CABs are bought at a price that implies a stated return calculated on a basis of the bond being payable at par at maturity. With no stated interest rate there is no interest paid until maturity, at which time all of the compounded accreted interest is paid. With no interest payments required in the beginning years of the bonds, this would enhance the cash flow in the beginning years of the business.

CABs do, however, have several drawbacks over other types of available financing. First, the interest rates on CABs are typically higher than both the fixed-rate and VRDOs. Second, investors prefer not to have a prepayment option on CABs, which limits the flexibility of the government to call the bonds early if revenue collections are better than anticipated or if a restructuring of the debt is needed. This structure is used frequently for various government borrowings, but we've not ever heard of this being used for telecom—although there is no reason why it could not be used.

Private Financing Options

The traditional way for commercial ventures to get financed is through bank loans. The interest rates on such loans are generally higher than bonds. Still, there are some ways to mitigate the financing costs so

that a project doesn't have to rely on only bank loans. Here are some thoughts on financing the fiber business if it is a non-municipal venture:

Equity: Most forms of private financing require some equity. Equity means that the borrowing entity brings some sort of cash or cash equivalent to the business as part of the financing package. The amount of equity required will vary according to the perceived risk of the venture by the lender. The higher the risk, the more equity required.

Equity can take a number of different forms:

- Cash: Cash is the preferred kind of equity and lenders like to see cash infused into a new business that can't be taken back out or that doesn't earn an interest rate.
- Preferred Equity: For a stock organization (like an LLC or other type of corporation) the business can issue some form of preferred stock that then acts as equity. Preferred equity usually gets some sort of interest rate return, but the payments are not usually guaranteed like they are for bank loans. If the business gets into a cash crunch, they must pay bank loans and other forms of debt before they pay preferred equity interest.
- Assets: It's possible to contribute assets as equity. For example, a new fiber venture might be seeded by having one of the partners contribute an existing fiber route or other valuable asset to the business. In such a case the contributed asset generally has to be assigned a market value by an independent appraiser.
- Non-recourse Cash: Non-recourse cash would be taking cash in an obligation that is not guaranteed to be paid back. To give an example, in Sibley and Renville counties, a fiber business was recently launched in the form of a cooperative. The local government provided an economic development bond to the business as a non-recourse loan. This means that the new fiber business will make their best effort to make the bond payments, but if they are short of cash then the government entities who issued the bonds would have to make bond payments. The other sources of financing for that project looked upon these bonds as a form of equity.

Bank Loans: While there are around 150 municipal fiber ventures in the country that largely have been financed through bonds, the vast majority of other fiber projects in the country have been financed with commercial lending sources. Most fiber projects have been built by for-profit communications companies or by cooperatives.

The banking industry as a whole does not like to finance long-term infrastructure projects. This is the primary reason why the country has such an infrastructure deficit. Fifty or so years ago, banks would fund things like power plants, electric and water systems, and other long-term revenue-generating assets. But various changes in banking laws, which have required banks to maintain larger cash reserves, along with a general desire to go after higher interest rate projects mean that banks have largely stopped doing this kind of lending. It's not impossible to finance an infrastructure project at a traditional bank, but the general parameters of bank loans make it a challenge.

Most banks prefer not to make loans with a term much longer than 12–15 years, and very few telecom projects can generate enough cash in that time period to pay for the original investment.

Bank loan rates are generally a few percentage points higher than bond rates, which also makes it harder to prove feasible.

Also, bankers generally expect a significant amount of equity from the borrower. The banking industry has gotten much more conservative over the last decade and they now might require 40% equity where a decade ago for a similar project they might have required 20% equity. Since fiber projects are relatively expensive, it's difficult to raise the kind of equity needed to make a project work.

There are exceptions. A few of the large banks like Key Bank and Bank of America have divisions that will make bank loans to municipal ventures that look a lot like bonds. These loans will have long payment terms of 20 years or more and reasonable interest rates. However, most of these loans go for things like power generation plants and other projects that have a strong guaranteed revenue stream. These banks have done a tiny handful of telecom projects, but they view most of them to be too risky. Banks are also somewhat adverse to start-ups and prefer to make these kinds of loans to existing businesses that already have a proven revenue stream.

There is one unique banking resource available to companies who want to build fiber projects. This is CoBank, a boutique bank and a cooperative. This bank has financed hundreds of telecom projects, mostly for independent telephone companies and for electric cooperatives. CoBank is a relatively small bank and has strict requirements for financing a project. They are leery of start-ups and we can't think of a start-up they have financed recently. They also expect significant equity to be infused into a new venture. They tend to have somewhat high interest rates and somewhat short loan terms of 10–12 years.

The final source of bank financing is local banks. Historically local banks were the source in many communities for car and home loans. But over the last few decades those loan portfolios have migrated to other lenders and local banks have been struggling for a decade to find worthwhile projects in their regions. We know of many commercial projects for small telcos that have been financed by local banks.

One of the issues of borrowing from a local bank is that they are going to have a relatively small lending limit. Most local banks won't make an individual loan for more than one or two million dollars. That obviously doesn't go far in a fiber project. However, local banks have become adept at working in consortiums of multiple banks to make larger loans. This spreads the risk of any one loan across many banks. Banks who do this usually take part in consortium loans for a number of projects. These smaller banks see this as a way to make loans to quality projects and quality customers that they could not loan to on their own.

To make this work you generally must start with a bank that is local to the project and let them help you put together the consortium. They essentially become the sponsor of the deal. This approach takes some extra work to put together, but there are many examples of this working for financing good projects.

Comparing Bond and Bank Financing

Benefits of Bond Financing: There are several major benefits for using bond financing:

- The term of the bond can match the expected life of the assets and it is not unusual to find bonds for fiber projects that stretch out for 25 to 30 years. It's difficult to finance a commercial loan longer than 15 years. The longer the length of the loan, the lower the annual bond payments.
- Bonds can be used to 100% finance a project, meaning there is no need for cash or equity to fund the new business. Lack of cash equity is generally the requirement that creates a challenge for traditional commercial financing.
- Bonds often, but not always, have lower interest rates. The interest rate is dependent upon several factors including the credit-worthiness (bond rating) of the borrower as well as the perceived risk of the project.
- It's generally easier to sell bonds than to raise commercial money from banks. Sometimes bonds require a referendum, but once bonds are approved there is generally a ready market for buying the bonds and raising the needed funds.

Benefits of Commercial Financing: There are also a few benefits for commercial financing.

- Generally, the amount that must be borrowed from commercial financing is lower, sometimes significantly lower. This is due to several issues associated with bond financing. Bond financing often contains the following extra costs that are not included with commercial loans:
    - Surety: Bonds often require a pledge of surety to protect against default of the bonds. The two most common kinds of surety are the use of a debt service reserve fund and bond insurance. A debt service reserve fund (DSRF) borrows some amount of money, perhaps the equivalent of one year of bond payments and puts it into escrow for the term of the bond. They money just sits there to be used to help make bond payments should the project have trouble making the payments. Bond insurance works the same way and a borrower will pre-pay and insurance policy at the beginning of the bond that will cover some defined amount of payments in case of a default.
    - Capitalized Interest: Bonds typically borrow the interest payments to cover bond payments for some period of time, up to five years.

- Construction Loans: Another reason that commercial financing usually results in smaller debt is through the use of construction loans. A commercial loan will forward the cash needed each month as construction is done, and interest is not paid on funds until those funds have been used. However, bonds borrow all of the money on day one and begin accruing interest expense on the full amount borrowed on day one. Construction loans also means that a borrower will only draw loans they need while bond financing is often padded with a construction contingency in case the project costs more than expected.
- Deferred Payment: Commercial financing often will be structured so that there are no payments due for the first year or two. This contrasts with bonds that borrow the money required to make these payments. Fiber projects, by definition, require several years to generate revenue and deferring payments significantly reduces the size of the borrowing.

- Retirement of Debt: It's generally easy to retire commercial debt, which might be done in order to pay a project off early or to refinance the debt. This contrasts to bonds that often require that the original borrowing be held for a fixed number of years before it can be retired.

Grants. There are a handful of possible sources of grants:

Minnesota Border-to-Border Grants: These grants were awarded annually from 2014 t 2017, but no grants were awarded in 2018. There is hope that these grants will be funded again this year. The grants are set by the Minnesota legislature and are administered through DEED (Department of Employment and Economic Development). In 2014 the amount of grants was $20 million and for 2015 was $10 million and was $20 million again in 2016 and 2017.

There are a few key rules for Border-to-Border grants that are important to remember:

- The grants can only be awarded to serve areas that are defined as unserved or underserved. Unserved areas are those that have no landline broadband alternative available. Underserved areas are those that have a landline option but which don't have a broadband provider that offers download speeds of at least 100 Mbps.
- The largest grant award is $5 million, although the majority of the grants awarded in previous years were for less than this.
- The grants can only be given to the entity that is going to own and operate the network.
- The entity getting the grant has to be an operating entity already in business. They won't give a grant to a start-up that doesn't yet have customers or a company that is still in the process of being formed. Because of this almost every grant award so far has gone to telephone companies, with a few to cable companies.
- The grant money must be used within 2 years of the award.
- Anybody applying for a grant has to show proof that they have secured the financing required for the matching part of the grant.
- The grants will provide up to 50% of a project. But projects that ask for less than 50% have an easier time getting funded.
- Not all assets are eligible for the grants. Generally, only the direct assets that will provide broadband directly to customers are eligible.
- While it's not an official rule, these are awarded by the state and we've seen that in any given year the awards are spread around to different parts of the state as much as possible

Federal Broadband Grants: There are several federal broadband grant programs that might benefit this project.

e-Connectivity Grant Program. In March of 2017 Congress passed a one-time $600 million grant/loan program to build rural broadband. The project has been labeled as the e-Connectivity Pilot. Grants for this program are due in only a few months and it's too late now to start an application for these grants. However, it's still worth discussing since many of the aspects of this grant are new and will likely be included in future federal grant programs. Some of the new grant requirements include:

- The grants are administered entirely by the Rural Utility Service, a branch of the US Department of Agriculture.
- The RUS has the discretion to award the money as 100% grant, or a combination of grants and RUS loans. The problem with the loans is that RUS loans always require that they be given first priority on all of the collateral of the borrower. This requirement has always stopped municipalities from borrowing from the RUS since government entities can't pledge their entire assets to a loan. But this requirement also stops a lot of telco and similar borrowers, because if they borrow primarily from some other lending source they are usually unable to make a primary lien pledge to two different lenders.
- Another new requirement is that an application can't cover an area that has more than 10% of households with access to broadband speeds of at least 10/1 Mbps. Recall that in Le Sueur County that much of the area of the county will theoretically see speed increases to at least 10/1 Mbps. This means that, while the broadband is still slow that it will be hard to qualify for a grant. The county is also largely covered by WISPs that all advertise that they have 25 Mbps broadband, although many may actually have speeds far slower than that.
- The USDA has also made it clear that they won't be making grants to any entity that doesn't have an established broadband business and strong balance sheet.

Farm Bill Grants. In the last Farm Bill there was a broadband grant program of $350 million to be awarded over the next five years, or roughly $70 million per year. The specific rules for this grant program have not been released, but they are expected to be similar, and maybe identical to the e-connectivity grant described above.

Other USDA Grants. There are several small USDA grant programs that vary from a few million to $20 million per year (varies every year). However, these grants are awarded according to the economic need of the grant area and the grants typically go to the poorest parts of the country such as Indian tribal areas and Appalachia. It's unlikely that Le Sueur would ever qualify for these grants.

Federal Programs

Another way to help finance broadband projects is through federal loan guarantees. A loan guarantee is just what it sounds like. Some state or federal agency will provide a loan guarantee, which is very much like getting a co-signer on a personal loan. These programs guarantee to make the payments in the case of a default and thus greatly lower the risk for a lending bank. In return for the lower risk, the banks offer significantly lower interest rates.

These guarantees are not free. There is an application process to get a loan guarantee in much the same manner as applying for a bank loan or a grant, meaning lots of paperwork. And then the agency making the guarantee will generally want a fee equal to several interest "points" up front. To some extent, this process works like insurance and the agency keeps these fees to cover some of the cost of defaults. If they issue enough loan guarantees, then the up-front fees can cover eventual losses if the default rates are low. These points are a payment to the agency for issuing the guarantee and are not refundable.

There are several federal agencies that might be willing to make loan guarantees for telecom projects. The following agencies are worth considering:

HUD 108 Program: The Department of Housing and Urban Development has a loan and loan guarantee program that is allotted for economic development. There is both federal money under this program as well as money from this program given to the state to administer. While these loans and loan guarantees generally are housing related, the agency has made loan guarantees for other economic development projects that can be shown to benefit low- or moderate-income households. If enough of a fiber project can be said to benefit low-income residents, then these loans can theoretically be used for a fiber project.

Small Business Administration 504 Loan Program: This program by the SBA provides loans or loan guarantees to small start-up businesses. These loans or loan guarantees must be made in conjunction with a bank, with the bank providing some loan funds directly and with the SBA loaning or guaranteeing up to 50% of the total loan.

USDA Business and Industry Guaranteed Loans (B&I): The Department of Agriculture provides loan guarantees through the B&I program to assist rural communities with projects that spur economic development. Such a project must, among other things, provide employment and improve the economic or environmental climate in a rural area. These loan guarantees are available to start-up businesses. The program can guarantee up to 60% of a loan over $10 million or greater percentages of smaller loans.

Rural Utility Service (RUS): This is a part of the Department of Agriculture. We cover their loan program in detail just below in this report. They also can provide loan guarantees. These come with the same sorts of issues associated with the loans. These loans and loan guarantees can only be used in communities of that do not include cities of 20,000 population or greater, which would not be an issue in Le Sueur County.

The Rural Broadband Access Loan and Loan Guarantee Program (Broadband Program) furnishes loans and loan guarantees to provide funds for the costs of construction, improvement, or acquisition of facilities and equipment needed to provide broadband in eligible rural areas. These loans can't be used for any town with a population over 20,000.

RUS makes broadband loans and loan guarantees to:

- Finance the construction, improvement, and acquisition of facilities required to provide broadband including facilities required for providing other services over the same facilities.
- Finance the cost of leasing facilities that are required to provide broadband if the lease qualifies as a capital lease under Generally Acceptable Accounting Procedures (GAAP). The financing of such a lease will be limited to the first three years of the loan amortization period.
- Finance the acquisition of facilities, portions of an existing system, and/or another company by an eligible entity, where acquisition is used in the applicant's business plan for furnishing or improving broadband. The acquisition costs cannot exceed 50 percent of the broadband loan amount, and the purchase must provide the applicant with a controlling majority interest in the equity acquired.

- Finance pre-loan expenses, i.e., any expenses associated with the preparation of a loan application, such as obtaining market surveys, accountant/consultant costs for preparing the application, and supporting information. The pre-loan expenses cannot exceed 5% of the broadband loan excluding any amount requested to refinance outstanding telecommunication loans. Pre-loan expenses may be reimbursed only if they are incurred prior to the date on which notification of a complete application is issued.

RUS is allowed to make loans to a wide range of entities. Borrowers can be either nonprofit or for-profit and can be one of the following: corporation; limited liability company (LLC); cooperative or mutual organization; Indian tribe or tribal organization as defined in 25 U.S.C. 450b; or state or local government, including any agency, subdivision, or instrumentality thereof. Individuals or partnerships are not eligible entities.

To be eligible to receive a loan under this program, the entity must:

- Submit a loan application. We note that the loan application requires a lot of work including such things as pre-engineering, surveys, mapping, financial business plan models, environmental impact studies, and other things which make the application expensive to get prepared externally;
- Agree to complete the build-out of the broadband system described in the loan application within 3 years from the date the borrower is notified that loan funds are available;
- Demonstrate an ability to furnish, improve, or extend broadband in rural areas;
- Demonstrate an equity position equal to at least 10 percent of the amount of the loan requested in the application; and
- Provide additional security if it is necessary to ensure financial feasibility as determined by the Administrator.

In practical terms here is how the RUS loans have been administered over the past few decades:

- The rules say that a project needs at least 10% equity, but in reality this is often expanded to be anywhere from 20% to 40% at the discretion of the RUS. In effect, the RUS acts as a bank and they will require enough equity that the project can adequately cover debt payments. In comparing the RUS to other banks, we would classify them as conservative.
- The loan terms are generally in the range of 12 years, sometimes up to 15 years for fiber projects. This is much shorter than the terms available on bond financing, meaning the annual payment would be higher under an RUS loan than with a bond.
- It is exceedingly hard to get a project funded for a start-up business. When one takes an RUS loan they essentially want the whole company as collateral. Thus, the bigger and the more successful the existing company, the easier to meet their loan requirements.
- Their collateral requirements are overreaching in other ways that make them hard to work with for municipal projects. For example, if your project was going to share fiber with some existing network, such as one built by a school system, they would want that asset as collateral. This is generally not possible.

This makes the RUS a very unlikely funding source for a municipal venture or for any start-up venture. To the best of our knowledge, they have never yet successfully funded a municipal venture and they rarely approve a project for a start-up business unless it is extremely well funded by a demonstrably successful company.

The other big drawback of these loans is that they take a long time to process. They often have a backlog of loan applications at the RUS of 12–18 months, meaning you have to wait a long time after application to find out if they will fund your project. Very few existing companies are willing to wait that long unless they are certain they will be funded. And if you are coordinating these loans with other forms of financing this wait is not practical. The loans are granted by using a very detailed checklist and rating system. This system gives a big preference to making new loans to existing RUS borrowers.

However, the loan fund is really large and is currently at nearly $1 billion. Congress generally has been adding additional funds to the RUS pot each year. The RUS also has some discretion and they have it within their power to make a grant as part of the loan. This is something that can't be counted on, but we know of projects where the borrower only had to pay back 80% of what they borrowed. The interest rates can be lower than market in some cases, but for the last several years, with low interest rates everywhere, the RUS loan rates were not much cheaper than commercial loans.

These loans also require a significant paperwork process to drawdown funds along with significant annual reporting requirements.

There is a low likelihood that RUS would be a funding source for a project in the county.

Opportunity Zones. Congress created a new tax opportunity as part of the 2017 Tax Cuts and Jobs Act. The Act created Opportunity Zones in which investors can get special capital gains treatment and other tax breaks for investing in qualified infrastructure within an opportunity zone. Each state governor then designated specific opportunity zones. Unfortunately, there is not an Opportunity Zone currently in Le Sueur County.

Qualified investments made inside that area can get special tax treatment. The first benefit is that taxes can be deferred from past investments if the gains are invested inside of an opportunity zone. For example, if an investor had a capital gain from the sale of a property, they could invest those gains and not pay taxes on the gains now, but have those gains deferred until as long as 2047. Investors have until 2026 to make such investments.

An investor also gets tax forgiveness on new investments made inside the opportunity zones if that investment is held for at least 10 years. Most of the opportunity zones include sizable areas of low-income residents and a qualified investment must meet a test of benefitting that community in some significant way. A fiber optic network that will bring broadband to all of the homes in an opportunity zone should meet that test – there are lot of demonstrable benefits of fiber.

It's possible that in future years that the governor of Minnesota could designate some part of the county to qualify for this special tax treatment.

New Market Tax Credit. The New Markets Tax Credit (NMTC) Program was established in 2000 as part of the Community Tax Relief Act of 2000. The goal of the program is to spur revitalization efforts of low-income and impoverished communities across the United States and Territories. Eligibility of the county to use these funds would depend upon meeting the earnings test. However, much of rural America meets this test if you earmark the funds for the rural parts of a project.

The NMTC Program works by giving big tax credits to investors that are willing to invest in infrastructure projects in qualifying communities. The tax credits are so lucrative that often the other terms for accepting the funding are modest. The tax credit equals 39% of the investment paid out—5% in each of the first 3 years, then 6% in the final 4 years, for a total of 39%.

The Community Development Financial Institutions (SDFI) Fund and the Department of the Treasury administer the program. The process of how the Treasury allots credits is a complicated one and we won't cover it, but in the end there are entities who end up each year with some amounts of New Markets Tax Credits that they must invest to gain the tax credits. The credits are often purchased by the large national banks or other firms that invest in infrastructure.

Generally, in practice, these funds act like a mix of loans and credits to the recipient. For instance, a community that received these funds might have to pay some modest amount of interest during the 7 years of the tax credit, and at the end would have a balloon for the principal. However, often some or even all of the principal will be excused, making this also look like a grant.

Because the entities that get the credits change each year, and because you apply with the entities that hold the credits, and not with the federal government, the processes for applying for this money are somewhat fluid. However, there are entities and consultants who help find New Market Tax Credits and who can help you through the maze of requirements.

These funds are not likely to fund a whole, or even a large percentage, of a fiber project, but they might be used to find 5% to 10% of the needed funds of a project and can be a very affordable piece of a funding package. In some cases, the terms for getting these credits are so good that other pieces of the financing might look at the tax credit money as equity.

State Programs

There are existing Minnesota programs that might provide some assistance to fiber projects. Following are several specific loan and grant programs that could provide some support for a fiber project. None of these grants are large enough that they are going to make a difference in whether the full project gets funded, but any money you can raise this way will lower the overall cost of debt financing. Each of these projects is specific about what they will or won't fund.

> **Minnesota Angel Loan Fund**: This is an economic development fund in Minnesota that is used to spur new start-up businesses. The funds come from the Minnesota Department of Employment and Economic Development.
>
> This is a loan fund and the program can make 0% interest loans for up to a 7-year term. The loans can be for as much as 10% of the amount of equity received by the start-up after approval in the program. That is an important point, in that the start-up business needs to register with this fund before raising equity and not after.
>
> At least one of the equity investors must be certified by the Minnesota Angel Tax Credit program and must also be qualified as an accredited investor per the US Security and Exchange Commission under Rule 501 of Section D. In a nutshell, that means that this must be a professional investor and

might be something like an insurance company, a pension fund, an investment bank, or some other entity that invests in businesses as a normal course of business. This would not include small private investors like the sort of investors that buy municipal bonds for personal investment purposes.

The amount of the loan must be at least $20,000 but is capped at $250,000. The loan payment is a balloon payment for the full amount due at the end of the seventh year. If the business is sold before the end of 7 years, the fund will charge a 30% premium on top of the principal due.

This loan only covers 10% above the amount of qualified equity the new business raises, but the zero percent interest rate still makes it attractive. However, fiber projects are generally of such a magnitude that even a loan of $250,000 will probably not make a huge difference in affecting the overall interest rate or in making it easier to raise the rest of the funding.

Greater Minnesota Public Infrastructure Program: This is a grant program that is part of the Small Cities Development Program. The purpose of this grant is to help stimulate economic development and jobs through investments in public infrastructure. Applicants must be home-rule cities that are outside of the 7-county metropolitan area. The money is available for any publicly owned infrastructure project and includes projects like water and wastewater, economic development projects, utilities, and streets. It seems by the description that municipally owned fiber projects should qualify.

The grants can be up to $1 million and a community can't receive more than $1 million in total over any 2-year period. The big catch of this program is that the municipality must make a cash contribution to the project. The community must put in equity equal to at least half of the amount of the grant. This matching can be either cash or in-kind. Fiber projects are often 100% debt funded, but perhaps a community that is willing to contribute land, buildings, or other in-kind assets to a fiber project should consider pursuing this grant as a way to stretch their contribution.

Minnesota Community Development Funding: This is a grant program that is aimed at municipalities of fewer than 50,000 people or counties with fewer than 200,000 residents. The grants are available for three different categories of projects—Housing, Water Projects, and Comprehensive Grants. Any project that is funded must meet certain tests, and one of these is that it provides benefits to people of low- and moderate-income.

The Comprehensive Grants are the ones that might be granted to fiber projects. A comprehensive grant can be up to $1.4 million. There is some expected matching by the community taking the grant, but this is not a specific formula like with the Greater Minnesota Public Infrastructure Program. Rather, the amount of matching is determined and negotiated as part of the grant process. However, the general rule of thumb is that the greater the matching the more likely a grant.

Comprehensive grants can be provided for economic development projects. This fund has never made a grant for a telecom project, but it appears that such programs could be eligible if they can demonstrate the benefit for low- and moderate-income households. A strategy might be to have at least part of the broadband project aimed at low-income households.

Customer Financing

When all else fails, an idea that we have seen work in other communities is for the citizens to step up and agree to somehow directly fund some or all of a broadband project. When you consider that the cost of building rural fiber can be $15,000 or more per home passed, getting some assistance directly from potential customers is sometimes the only solution that can attract the rest of the needed funding. There are several examples of places where this has been done in the country:

Property (or Other Kind of Tax) Revenues. It is possible to obtain some or all of the cost of a broadband network through a pledge of future tax revenues. That pledge can then support a bond. This is different than most bonds for a broadband network where the network would be secured by revenues of the broadband venture. But a pledge of some other kind of tax revenue is one of the easiest ways to get a bond. There are some real examples of this kind of financing:

- Leverett, Massachusetts: In Leverett MA, the citizens all voted to raise property taxes to fund and build a municipal fiber project. This is a relatively small town of about 2,000 people, but there was enough demand for broadband that a ballot initiative passed easily to use property revenues to pay for the fiber.
- UTOPIA, Utah: UTOPIA is a consortium of a number of small towns in Utah that banded together to get fiber. They also have pledged property tax revenues to fund part of the cost of the network.
- Cook County, Minnesota: Cook County funded about half of their fiber network using a federal grant awarded from the Stimulus funding program in 2008. The county held a referendum and used a sales tax increase to pay for the matching funds needed to build the project.

Direct Customer Contributions: It's also possible to pay for some of a broadband project through direct contribution of possible customers. This has never been done on a large scale because it would be exceedingly difficult to get a lot of residents to agree to write a check to fund a network. But there are some examples to consider:

- Contribution to Aid in Construction: Most utilities have a program where they will agree to extend their network to customers if those customers agree to pay the cost of the connection. We are aware in the broadband area of numerous cases where small pockets of rural home raised the needed money to get connected to a nearby broadband network.
- Ammon, Idaho: This is the only municipal attempt at funding a network in this way. The City of Ammon will connect customers to a fiber network if they will contribute $3,500 up-front to cover the cost of construction. This program is just getting started and it reportedly has a few hundred homes interested. But it's an unusual combination of a city prompting citizens to pay for the needed network themselves.

Public Private Partnerships

A public private partnership (PPP) is formed when a government entity and commercial entity fund a project together. There is no one model for a PPP and such an arrangement can be structured in many different ways. The main benefit of a PPP is that the commercial operator of a project benefits by getting some bond financing from the municipal partner. This allows the business to blend the benefits of bond

and commercial financing and is one of the ways that makes it easier to get through the first few years of the project.

The general benefits of bond financing are what makes public money attractive to a commercial partner—low interest rates, long repayment term, and small or no payments for the first few years. But the downside is that there are more overall financing costs and in the long run a bond makes a project cost more in terms of cash. The safety of a bond in the first few years, though, can be very attractive.

Combining Public and Private Financing. There are benefits to combining the two kinds of financing:

- Banks will often consider the financing that comes with bonds as the equivalent of equity, meaning that the commercial partner will not require as much, or even no, cash equity.
- In terms of the amount borrowed, the two methods work well together if construction loans are used to cover the construction and bond financing is used for the longer-term financing costs.
- Combining the two methods works to produce a payment term that is longer than a traditional commercial loan.
- Combining the two methods also usually means lower debt payment during the first few critical years while the network is being built.
- Both municipalities and commercial telcos have a natural borrowing limit—meaning that there is always some upward limit on the amount of money they can borrow. Combining both kinds of financing can mean that neither partner has to hit their debt ceiling. Just as an aside, the debt ceiling is often the main impediment to funding project 100% with bonds. Fiber projects are generally large projects and the required funds can easily exceed the ability of a government to fund it 100%.

There are numerous PPP broadband projects around the state. Here are two that are interesting models to consider:

- RS Fiber: RS Fiber is a new broadband cooperative that was formed in Renville and Sibley counties. The project was funding from various sources including a loan for 25% of the project supplied a bond backed by the cities and counties involved in the project.
- Swift County: The county government there contributed a significant percentage of the cost needed to construct a broadband network in the county. The bond proceeds were loaned to Federated Telephone Cooperative and are expected to be paid back over time.

Other Sources of Financing

We've seen entities get very creative in finding sources of financing. Take the example of the RS Fiber Cooperative formed in Sibley and Renville counties. Their financing includes two unique revenue sources we have not seen used before:

- **Loans from Individuals**: The Cooperative borrowed money directly from people and businesses in the service area. These loans had loan contracts and covenants like any other loans. The money borrowed in this manner reduces the amounts that have to be borrowed from the larger external sources, and generally these loans avoid the large fees associated with external financing.
- **Loans from Cooperatives**: Since RS Fiber is a cooperative, they found that they were able to borrow from an electric cooperative at low interest rates. Cooperatives are a unique type of business that is required by law to either invest their profits back into the business or else return it as dividends to members. Because the amount of dividends is limited by law, cooperatives often

find themselves with large cash reserves. They are allowed to loan out these cash reserves, but only to other cooperatives.

EXHIBIT I: SERVICE AREAS OF THE INCUMBENT TELEPHONE COMPANIES

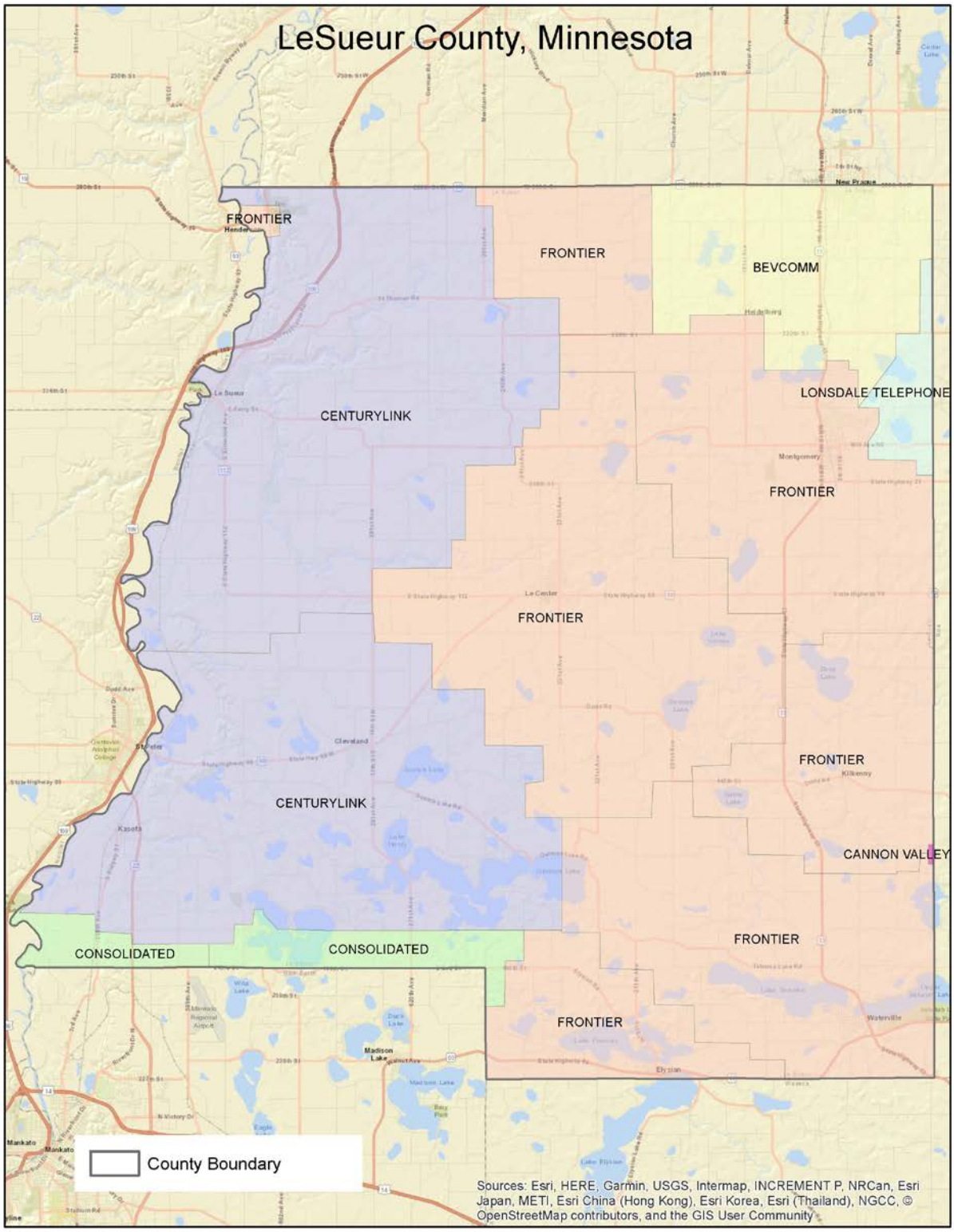


EXHIBIT II: STUDY AREA

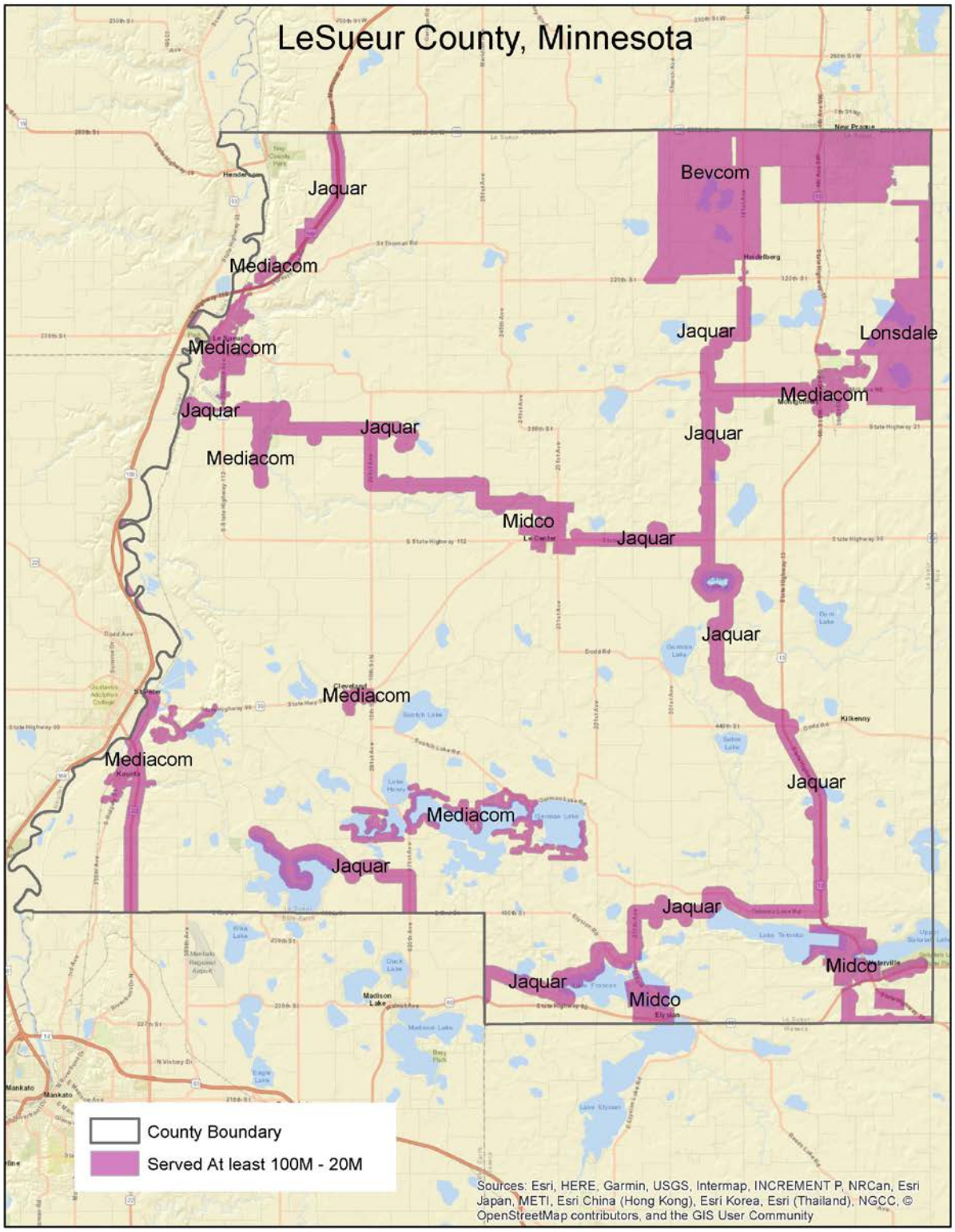


EXHIBIT III: Map of the Backbone Fiber

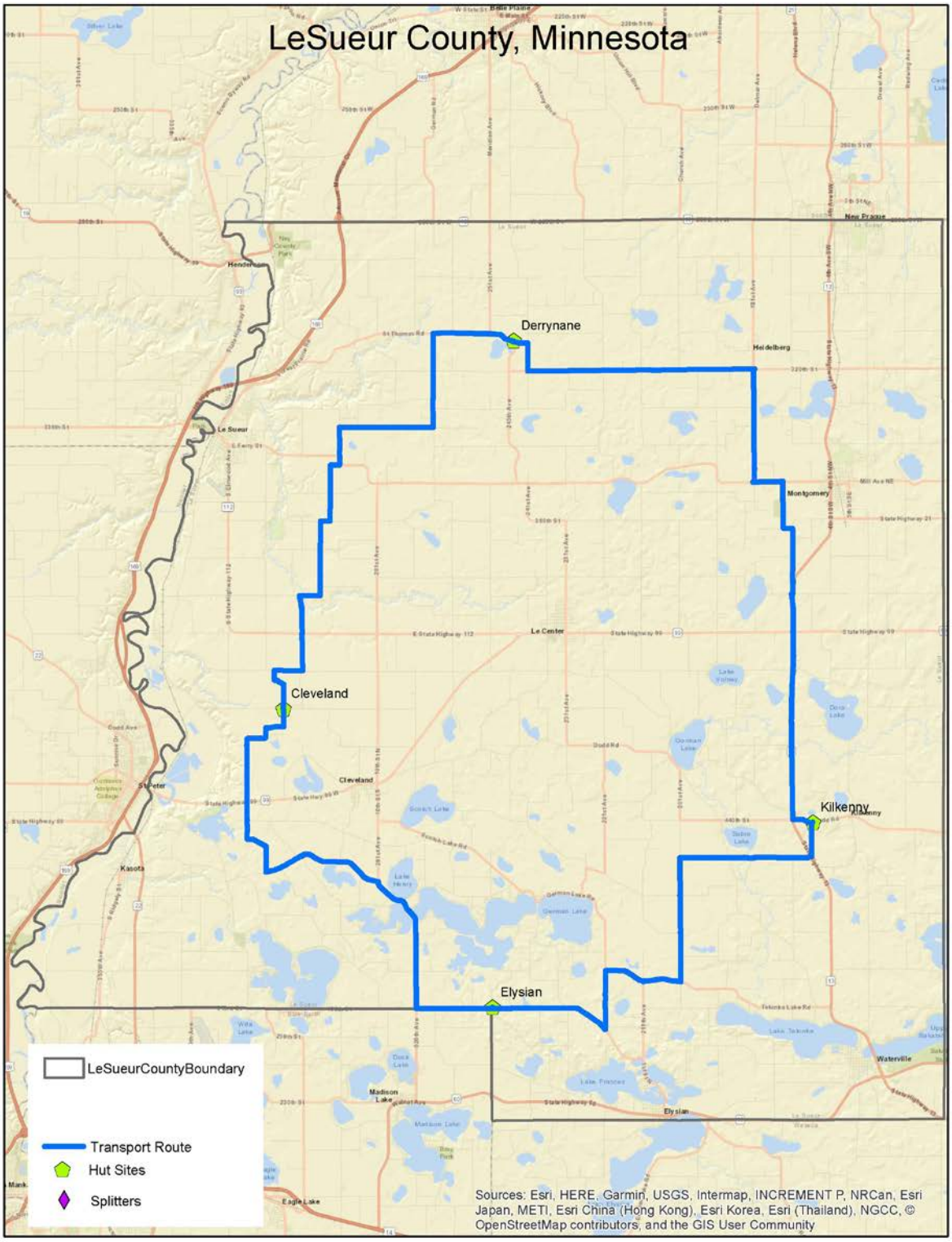


EXHIBIT IV: SUMMARY OF FINANCIAL RESULTS

	Assets	Take Rate	Passings	Equity	Debt	Total Financing	Year 20 Cash	Net Inc Positive	Cover Debt
COUNTY AS THE ISP									
1. Revenue Bond Financing	$16.80 M	70%	2,402		$22.60 M	$22.60 M	-$17.66 M	Never	Never
2. GO Bond Financing	$16.80 M	70%	2,402		$20.40 M	$20.40 M	-$16.93 M	Never	Never
3. GO Bond plus $5M Grant	$16.80 M	70%	2,402		$14.40 M	$14.40 M	-$9.46 M	Never	Never
UNSERVED AREAS WITHOUT BEVCOMM									
4. Base 1	$16.58 M	70%	2,402	$3.78 M	$15.13 M	$18.91M	-$10.50 M	Year 20	Never
5. 80% Penetration	$17.03 M	80%	2,402	$3.84 M	$15.38 M	$19.22 M	-$7.64 M	Year 17	Never
6. Higher Interest Rate	$16.58 M	70%	2,402	$3.81 M	$15.25 M	$19.06 M	-$11.56 M	Year 20	Never
7. Higher Broadband Prices	$15.58 M	70%	2,402	$3.76 M	$15.05 M	$18.81 M	-$8.65 M	Year 18	Never
8. No Contingency	$16.58 M	70%	2,402	$3.56 M	$14.23 M	$17.78 M	-$9.10 M	Year 20	Never
9. With $1 Million Grant	$16.58 M	70%	2,402	$3.55 M	$14.20 M	$18.75 M	-$9.10 M	Year 20	Never
10. With $5 Million Grant	$16.58 M	70%	2,402	$2.66 M	$10.63 M	$18.28 M	-$3.70 M	Year 20	Never
11. Most Optimistic	$15.82 M	75%	2,402	$2.46 M	$9.85 M	$18.32 M	-$0.90 M	Year 13	Never
UNSERVED AREAS WITH BEVCOMM									
12. Base 2	$17.42 M	70%	2,539	$3.96 M	$15.83 M	$19.78 M	-$10.37 M	Year 20	Never
13. 80% Penetration	$17.90 M	80%	2,539	$4.02 M	$16.08 M	$20.09 M	-$7.35 M	Year 15	Never
14. Higher Interest Rate	$17.42 M	70%	2,539	$3.98 M	$15.93 M	$19.91 M	-$11.47 M	Year 20	Never
15. Higher Broadband Prices	$17.42 M	70%	2,539	$3.93 M	$15.73 M	$19.66 M	-$8.41 M	Year 17	Never
16. No Contingency	$16.38 M	70%	2,539	$3.72 M	$14.88 M	$18.59 M	-$8.91 M	Year 18	Never
17. With $1 Million Grant	$17.42 M	70%	2,539	$3.73 M	$14.90 M	$19.63 M	-$8.98 M	Year 20	Never
18. With $5 Million Grant	$17.42 M	70%	2,539	$2.83 M	$11.33 M	$19.16 M	-$3.57 M	Year 18	Never
19. Most Optimistic	$16.64 M	75%	2,539	$2.63 M	$10.53 M	$18.16 M	-$0.65 M	Year 13	Never

	Assets	Take Rate	Passings	Equity	Debt	Total Financing	Year 20 Cash	Net Inc Positive	Cover Debt
RURAL COUNTY WITHOUT BEVCOMM									
21. 80% Penetration	$18.42 M	80%	2,954	$4.08 M	$16.30 M	$20.38 M	-$3.15 M	Year 11	Never
22. Higher Interest Rate	$17.85 M	70%	2,954	$4.03 M	$16.13 M	$20.16 M	-$7.80 M	Year 16	Never
23. Higher Broadband Prices	$17.85 M	70%	2,954	$3.98 M	$15.90 M	$19.88 M	-$4.41 M	Year 13	Never
24. No Contingency	$16.81 M	70%	2,954	$3.77 M	$15.08 M	$18.84 M	-$5.23 M	Year 13	Never
25. With $1 Million Grant	$17.85 M	70%	2,954	$3.78 M	$15.10 M	$19.88 M	-$5.30 M	Year 13	Never
26. With $5 Million Grant	$17.85 M	70%	2,954	$2.88 M	$11.53 M	$19.41 M	$0.11 M	Year 11	Year 20
27. Optimistic	$17.04 M	75%	2,954	$2.64 M	$10.70 M	$18.34 M	$5.65 M	Year 5	Year 15
RURAL COUNTY WITH BEVCOMM									
28. Base 4	$19.18 M	70%	3,233	$4.27 M	$17.08 M	$21.34 M	-$5.75 M	Year 13	Never
29. 80% Penetration	$19.45 M	80%	3,233	$4.30 M	$17.20 M	$21.50 M	-$1.91 M	Year 11	Never
30. Higher Interest Rate	$19.18 M	70%	3,233	$4.30 M	$17.20 M	$21.50 M	-$6.94 M	Year 13	Never
31. Higher Broadband Prices	$19.18 M	70%	3,233	$4.24 M	$16.95 M	$21.19 M	-$3.25 M	Year 11	Never
32. No Contingency	$18.08 M	70%	3,233	$4.02 M	$16.08 M	$20.09 M	-$4.20 M	Year 11	Never
33. With $1 Million Grant	$19.18 M	70%	3,233	$4.04 M	$16.15 M	$21.19 M	-$4.35 M	Year 13	Never
34. With $5 Million Grant	$19.18 M	70%	3,233	$3.14 M	$12.58 M	$20.72 M	$1.06 M	Year 11	Year 20
35. Optimistic	$18.37 M	75%	3,233	$2.90 M	$11.60 M	$19.50 M	$7.18 M	Year 4	Year 15