Teller County and Western El Paso County Broadband

June 2016

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Introduction and Executive Summary

In the fall of 2015, Teller County, in partnership with the cities of Woodland Park, Cripple Creek and Victor and the Cripple Creek-Victor RE-1 and Woodland Park RE-2 school districts, engaged NEO Connect ("NEO") to prepare a business plan and strategy for broadband expansion and technical assistance for the County. In January of 2016, the service area was amended to also include the western part of El Paso County in the study area. The shared goal of the entities in Teller County and western El Paso County is to provide abundant, redundant and affordable Internet service to citizens, businesses and visitors. This report is the first of two reports that will be provided as deliverables for this project. This report will provide strategies for improving broadband services is the two-county region. A second companion report will provide strategies for improving cellular and public safety communications within Teller and western El Paso Counties.

There are a number of options and strategies for improving broadband services throughout Teller County and western El Paso County. Many of the strategies that can be considered; however, must be within the context of the current regulatory environment in Colorado. Currently the law in Colorado (Senate Bill 152 or "SB-152") restricts municipalities and counties from building out telecommunications infrastructure directly to homes and businesses and limits local governments from entering into Public-Private Partnerships to solve broadband challenges. The law allows local governments to build telecommunications infrastructure to

other government locations and quasi-government locations and allows use of these facilities on a very limited basis for service providers to use to offer services to the end users. There is a provision in SB-152 that allows a municipality or a county to opt-out of this law by a favorable majority public vote. Although as of April 2016, over sixty communities in Colorado have held elections to opt out of this restrictive law, the communities in Teller County and Western El Paso County have not yet held elections to opt out of this law. Therefore, although there are a number of strategies to pursue to improve broadband services within these two counties, the options that will primarily be explored in this strategic plan are under the current limitations and restrictions of Senate Bill 152.

Additionally, throughout the broadband planning process, there was much debate in regards to government's role in solving broadband issues. This report will provide a number of options for consideration for government to act as a facilitator and enabler in helping to solve challenges that contribute to lack of affordable and abundant broadband services. Feedback from the Local Technology Planning Team ("LTPT"), from county commissioners and city leadership included the desire to help address broadband gaps within the two counties, working with the private sector to enable better broadband, and also included the strong conviction that there was no desire for local governments to act as a service provider and compete against the private sector.

Therefore, this report will provide strategies for consideration that fall within the current confines of SB-152, coupled with the intended desire to work with the private sector to improve broadband services as an enabler and facilitator to this process. This report will also provide options for consideration if the communities and/or counties go forward with a SB-152 opt out, leveraging potential Public-Private Partnerships to help improve broadband services within the two county region.

Why this Matters, Broadband Infrastructure is Critical to our Communities' Economic Vitality

Our world is rapidly changing. Technology is impacting every part and parcel of our lives -- from where and how we conduct work, to whether or not we thrive economically and socially. The Internet has impacted the way we work and live including our entertainment, our culture, the way government services are provided and accessed, the way healthcare is being delivered, and the way we educate our children and provide education to better improve our workforce. With the introduction and accelerated advancement of technologies, having access to affordable,

redundant and abundant broadband is quickly becoming the most critical infrastructure of our time, just like electricity and transportation were in the early 1900's.

The importance of broadband was reflected in the recent Federal Communications Commission's (FCC) determination that broadband internet access is a utility, as necessary to contemporary life as electricity, roads, and water systems. Advanced broadband infrastructure has the potential to create more jobs, increase the community's competitive ability globally, create new technologies, increase opportunities for the region's companies, enhance public safety, provide better and less expensive healthcare, and provide greater educational opportunities throughout our communities.

Advanced broadband networks are creating seismic changes in local, state, national and global societies, as well as markets, business and in institutions around the world. Access to social media and the Internet has shifted governments, threatened political boundaries and changed us culturally. Advanced broadband networks are fundamentally changing our world in ways that were not expected or anticipated. Much like electricity, advanced broadband networks are the enabling technology in which all things are impacted. Electricity was invented to turn on the lights, but empowered – literally, the transformation to an industrial society.

Just as it was impossible to predict the impact that electricity would have to power modern appliances, computers, health monitoring systems, manufacturing facilities, computers, radio and television, and financial markets; so too, is it impossible to predict the impact and reach of advanced broadband networks. We do not yet know the far reaching impacts that the Internet will have on our lives and on generations to come. However, it is certain that NOT having access to advanced broadband networks would be equivalent to being in the dark without electricity.

Survey Results and Community Feedback Point to a Need for Better Broadband, Especially in areas Outside of Woodland Park.

NEO Connect fielded two surveys to obtain input from both the residential and business communities in regards to Teller County's broadband needs. One hundred ninety-five survey responses were received for the survey targeting households while thirty-four responses were received for the business and anchor institution survey. On the surface, 34 completions for the survey targeting organizations may seem low but given the smaller number of sample to pull from, we feel this provides good directional insights.

The survey asked and provided instructions to respondents to take an actual Internet speed test. The lowest speeds recorded were .31 Mbps download and .17 Mbps upload. The highest speeds recorded were 99 Mbps download and 97 Mbps upload.

More importantly, the **average speeds recorded were 8 Mbps download and 1.7 Mbps upload**. This is well below the FCC's new definition of broadband. In January of 2015, the FCC voted to change the definition of broadband by raising the minimum download speeds from 4 Mbps to 25 Mbps. Ninety-five percent of the speed tests recorded through the surveys were below the FCC's new definition of minimum broadband download speeds of 25 Mbps.

The fact that almost all (95%) of the administered speed test results do not reach the FCC's definition of broadband is a significant concern. Across Colorado as well as the United States towns, cities and communities are investing in networks that provide services that are 500 – 1000 times faster speeds than the capacity available in Teller and Western El Paso Counties. These communities recognize the power of broadband to work in today's digital economy as well as spark innovation. Teller and El Paso Counties, it could be surmised, lacks adequate broadband services to help businesses thrive and encourage citizens to stay. These real-world speed test results confirm the need for more abundant broadband.

Although the survey is a randomized sample, the results of the survey strongly suggest the following key takeaways:

- Speed, redundancy and price are what matters most to the respondents to the survey
- The community members want to see faster, more abundant broadband services
- The actual speed tests confirm the lack of adequate broadband services throughout the communities, especially in areas outside of Woodland Park

NEO also conducted community engagement meetings in Woodland Park, Florissant, and Cripple Creek. Perhaps one of the most poignant and convincing feedback regarding lack of sufficient broadband was during a community meeting with students of Cripple Creek High School. Because the school lacks sufficient broadband availability, students cannot take mandatory online testing at the same time, as the broadband connection will timeout or is too slow. The number of students taking the online tests must be limited and staggered throughout the week to accommodate the lack of available bandwidth. Staggering student testing is unnecessarily time consuming for the teachers, school administrators and students. Time that could be spent providing instruction and learning is being used to take online tests. In addition to provide strategies for improving broadband availability overall, this report will provide

strategies for leveraging grant funding to help improve broadband availability and bandwidth for schools.

Input from the Existing Service Providers, Potential "Middle Mile" Fiber Expansion

In the course of its evaluation of broadband delivery options, NEO Connect met with all of the local service providers. Service options within Woodland Park seem to be well served with Peak Internet's build out of their Fiber to the Premise network, and with TDS and CenturyLink fiber optic network expansion. Service options outside of Woodland Park are severely more limited with much of Teller County and parts of western El Paso County served by DSL, cable modem and satellite phone service.

Most of the existing service providers rely primarily on CenturyLink to serve this market. The existing service providers all stated that serving the western El Paso and Teller Counties market was more expensive than many other markets as there are few options available for providing backhaul and transport facilities for Teller and western El Paso Counties.

Fiber networks also require access to an Internet "supply" – locations where there is an Internet hub, backhaul or transport point, located in population centers. These Internet hubs can either be accessed by building fiber directly to the location, utilizing a point-to-point digital microwave link or leasing existing infrastructure. The costs for leasing existing facilities or backhaul are often based upon mileage. In either of these options, the costs to build directly from the Internet "supply" to rural areas are extremely capital intensive and/or the monthly access charges for leasing infrastructure are too high.

In rural areas, including Teller and western El Paso County, incumbent providers – primarily CenturyLink and Comcast - have infrastructure to link fiber back to these internet hubs. The internet hub for this region is based in Colorado Springs. However, incumbent carriers do not allow other entities or local governments to "tap into their fiber" to extend a network, as is common for new homes to tap into a main waterline. The only option to access the existing fiber infrastructure it to lease fiber and pay for the backhaul and transport fees to the Internet hubs in Colorado Springs. Since these costs are based upon mileage back to the Internet hubs, the monthly access fees are high. The only realistic options are to subscribe to the high monthly service fees or build back the long distance to the internet supply.

These high monthly backhaul charges or capital costs to connect to Internet hubs are difficult to finance since most rural areas do not have the population to support an adequate return on investment for any providers to upgrade their networks. This issue was raised with other providers serving the area. Peak Internet, TDS and Comcast all stated an interest in participating in a build effort to bring connectivity from Colorado Springs to Woodland Park and to the other communities of Divide, Florissant, Victor and Cripple Creek. Service providers discussed partnering with Teller County and El Paso County on the connections between the communities to allow for improvement of services throughout the County and to provide redundancy through another route that is an alternative to using CenturyLink's network. These fiber optic connections between communities and to the Internet hub are often referred to as "middle mile."

In addition to needing alternative routes in and out of Teller County for redundancy, having access to faster, more affordable broadband services are also needed. All of these variables are interrelated. Having more options to serve the Teller and western El Paso Counties market in terms of network facilities in and out of the Counties would not only impact the lack of redundancy options available, but also, having other alternatives to serve the Counties would greatly lower the costs for the current service providers providing services. It was clear that Teller County's and western El Paso County's current levels of broadband service are considerably more expensive and slower than what is currently available in other areas within Colorado, nationally, and globally.

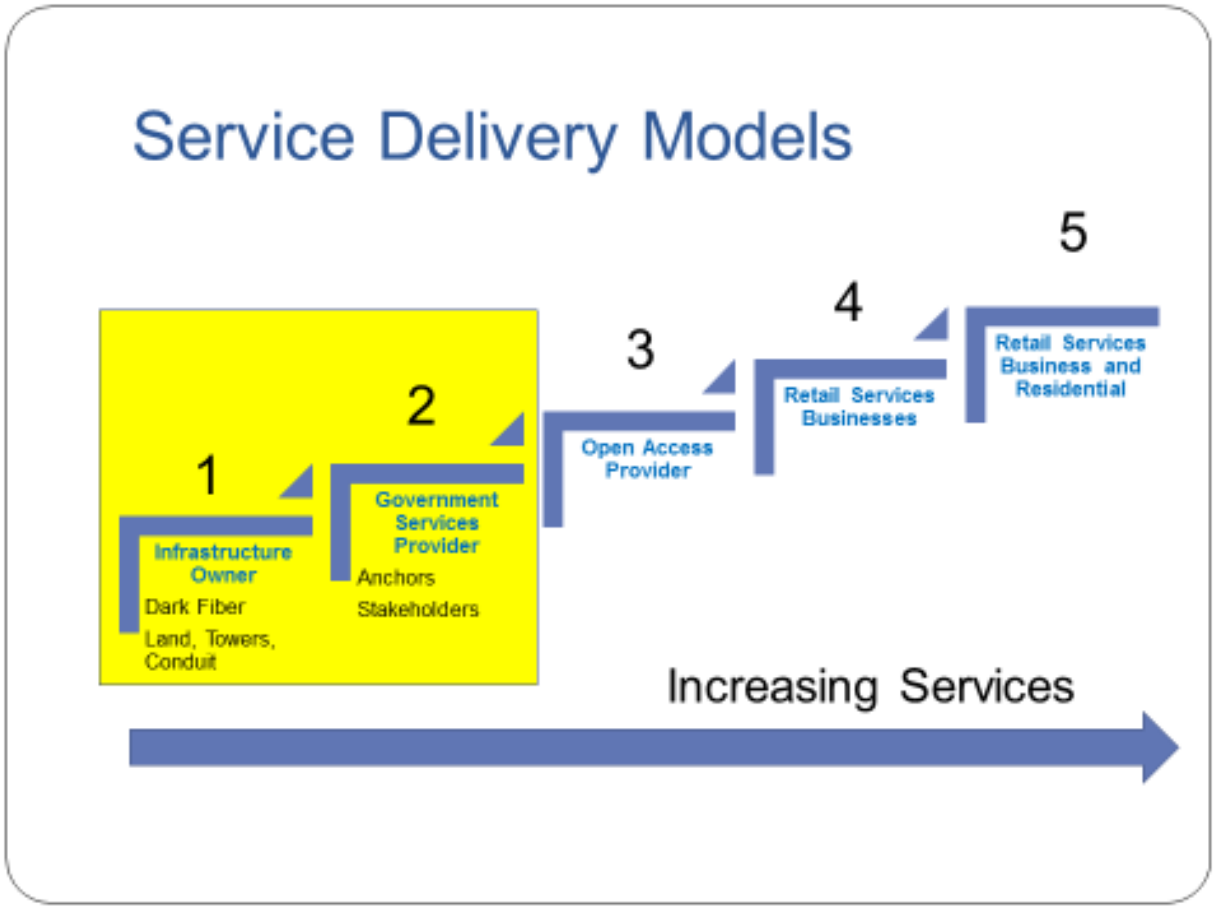
NEO Connect identified potential partnerships that could potentially be leveraged to reduce the capital costs of building new fiber along these routes. In addition to TDS, Peak Internet and Comcast that all expressed an interest, the City of Colorado Springs Utilities and CDOT are also interested in this build. Leveraging Rural Healthcare Grant opportunities may also all for a bulk of these routes to be paid for with grant monies. This will be discussed in detail in Section 6 of this report.

Extending the Middle Mile to Anchor Institutions

As stated previously, SB-152 allows government agencies to build telecommunications infrastructure to other government agencies and to quasi-government agencies including schools, libraries and medical establishments. These establishments are often referred to as "anchor institutions." Building fiber to the anchor institutions, which is allowed under SB-152, allows for the ability to offer 1 Gbps service to the anchor institutions. However, and more

importantly, building fiber to the anchor institutions allows Teller County and El Paso County to leverage several grants to fund the builds. For example, the Rural Healthcare Fund grant and the E-rate Program for schools will provide funding to pay for 65% of the capital costs for the middle mile portion of the build – the most expensive part in building to the other communities within the Counties.

Additionally, building fiber to the anchor institutions by leveraging grant funding gives needed fiber connectivity to the smaller communities within the County. For example, by building to the anchor institutions, Chipeta Park, Cascade, Green Mountain Falls, Manitou Springs, Woodland Park, Divide, Florrisant, and Cripple Creek communities become connected with fiber. Once fiber is built to these communities, wireless access points may be installed at the anchor institutions in each of these communities by the service providers. Wireless bandwidth is enhanced when it is fed with fiber. Wireless broadband could then be used to further expand and enhance broadband services to homes and businesses in these communities.



The picture above highlights the two service delivery models that can be considered given the current SB-152 regulatory envirnonment. Teller and El Paso County can provide infrastructure – i.e. conduit, dark fiber, land and tower space in limited capacity to solve broadband issues. Additionally, Teller and El Paso County can provide services to other government locations and anchor institutions. The models that are not highlighted could be implemented with a successful SB-152 opt out election. Within each of these models, there would be a number of options to explore for outsourcing operations, maintenance of network facilities and partnerships possible for providing broadband services.

Solving the "Last Mile" of Connectivity

Although building fiber between the communities and to Colorado Springs may improve cost of backhaul and transport fees for the existing service providers and provide more bandwidth capability to the communities, this build will not completely solve the "last mile" issues that are prevalent within the region. "Last mile" refers to the broadband connection at homes and businesses. Without opting out of Senate Bill 152, there are limited options available to government entities in actively solving the last mile connectivity within the region. Although the local service providers have invested in limited fiber optic infrastructure to key businesses and anchor tenants primarily within Woodland Park, other than Peak Internet's Fiber to the Premise expansion, the other existing providers' networks are primarily based upon cable modem, Digital Subscriber Line (DSL), satellite and wireless technologies for the last mile. Below is a brief description of the various technologies:

DSL (Digital Subscriber Line) uses existing copper phone lines to deliver download and upload broadband speeds typically of 1.5 Mbps to 7 Mbps. DSL speeds diminishes as distance increases from the telephone company's central office. Homes or businesses located more than three miles from the central office will not receive as fast of speeds. There have been many improvements to DSL technologies to improve the speed available. In general, most forms of DSL service improvements support up to 10 Mbps. VDSL (Very High Bit Rate Digital Subscriber Line) can support up to 30 Mbps, but most Internet service providers do not support this type of service, including providers in the Ute Pass region.

Cable modem service uses coaxial cables already installed by the cable TV operators to provide broadband service. Most cable networks support speeds comparable to DSL. Cable operators are upgrading their cable networks by installing fiber optic cable closer to neighborhoods.

These network improvements allow cable modem service to be able to support up to 30 Mbps. This connection type is a shared service, meaning, as more people are on the network within a neighborhood, the speed available to each customer diminishes.

Fiber optic technology converts electrical signals carrying data to light and sends the light through glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding current DSL or cable modem speeds, typically by tens or even hundreds of Mbps. Fiber is the best way to provide abundant broadband, but it often is the most capital-intensive to build. As fiber optic technology transmit pulses of light, more bandwidth can be delivered on a fiber optic network by adding various colors of light or additional spectrum. Fiber is unique because it can carry high bandwidth signals over long distances without signal or bandwidth degradation and it can provide that capacity in both directions – for both upload and downloading information.

Wireless broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility. Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas where DSL or cable modem service would be costly to provide or fiber network installations may be too capital intensive.

Wireless broadband can be mobile or fixed. Wireless speeds are generally comparable to DSL and cable modem. Wireless services can be offered using both licensed spectrum and unlicensed devices. Wi-Fi networks typically use unlicensed spectrum. Wi-Fi networks use wireless technology from a fixed point and often require direct line-of-sight between the wireless transmitter and receiver. Wi-Fi networks can be designed for private access within a home or business, or be used for public Internet access at "hot spots" such as restaurants, coffee shops, hotels, airports, convention centers, and city parks. Using licensed spectrum, greater amounts of bandwidth can be delivered and often do not require direct line-of-sight.

In some communities, especially sparse, geographically diverse rural communities, small providers build out a wireless solution since wireless infrastructure is not as capital-intensive as building out a fiber optic infrastructure. While wireless technology does have its limitations, needing to be designed to get around "line of sight' requirements as well as to support "shared" bandwidth on the network, smart engineering can deliver good connectivity.

Wireless Local Area Networks (WLANs) provide wireless broadband access over shorter distances and are often used to extend the reach of a "last-mile" wireline or fixed wireless

broadband connection within a home, building, or campus environment. An in-home Wi-Fi network is a WLAN – it does not use spectrum, rather it sends radio waves at a limited range. Mobile wireless broadband services are also becoming available from mobile telephone service providers. These services are generally appropriate for highly-mobile customers and require a special wireless card with a built-in antenna that plugs into a user's laptop computer. Generally, they provide lower speeds, in the range of several hundred Kbps.

Satellite broadband is another form of wireless broadband, and is also useful for serving remote or sparsely populated areas. Typically, a consumer can expect to receive (download) at a speed of about 500 Kbps and send (upload) at a speed of about 80 Kbps. These speeds are slower than DSL and cable modem, but they are about 10 times faster than the download speed with dial-up Internet access. Service can be disrupted in extreme weather conditions and are typically oversubscribed.

Teller County and western El Paso Counties and the participating communities in this study could potentially build facilities to other government locations, the schools and to the medical clinics and hospitals under the current SB-152 regulatory environment but would be restricted in further partnering with the private sector to extend services to homes and businesses. Additionally, under the current law, Teller County and El Paso County would only be able to allow use of the telecommunications network that it builds by the service providers on a limited basis. The law states that use of the network can be allowed by service provider to serve end users (homes and businesses) as long as this use is "insubstantial" compared to government use of the network. "Insubstantial use" is not defined in the law. With a SB-152 opt out, there would be more options to further explore in addressing the last mile solution under various forms of Public-Private Partnership models.

With or without an SB-152 opt out, the service providers could potentially either participate in a joint build, sharing the costs of the fiber between the communities, or could lease fiber from the Teller County/El Paso County entity. From there, the service providers could expand the network further into the remote communities using various types of last mile technologies.

NEO's Recommendations

With this brief introduction of the issues, obstacles, and potential outcomes, NEO recommends the following strategies for Teller County and western El Paso County. These strategies will be addressed in detail after this section.

1. Hold an election to opt out of SB-152.

2. Implement broadband-friendly policies and ordinances in each of the cities, towns and counties to help reduce the cost of broadband expansion.
3. Partner with CDOT, Colorado Springs Utilities, Peak Internet, Comcast and TDS to build key routes from Colorado Springs to the various communities. Reach out to IREA, Black Hills Energy, and Park County in regards to also potentially partnering and sharing in the capital costs.
4. Leverage grant funding – namely, the Department of Local Affairs (DOLA), the Rural Healthcare Grant, E-rate and others to pay for a significant part of these builds. These grant programs will pay for 50-65% of the capital costs to connect government entities, schools and the medical establishments. Many of these grants will also pay for the middle mile portion of these builds to connect various government and quasi-government locations. Each of the grant programs can be further leveraged to maximize the grant funding available.
5. Build fiber optic facilities to all of the communities by building to the anchor institutions, and possibly build fiber to the tower locations within the County, creating redundancy in and out of Teller County and improving services within each community.
6. Allow service providers to participate in joint builds and to install wireless access points and/or use the fiber to extend their services to homes and businesses.
7. Create a non-profit organization with participating communities and counties as members to apply for grant funding, build and own infrastructure, and create an advocacy team regarding broadband implementation and expansion. The existing structure of the Local Technology Planning Team ("LTPT") would not be able to apply for funding and own infrastructure. A new entity could be set up for this purpose. Intergovernmental agreements could be established between this new entity and the various government organizations in regards to ownership and use of fiber or telecommunications infrastructure.

Capital Costs Required for Implementation and Potential Phases.

The total projected capital costs for building fiber from Colorado Springs to Woodland Park and to all of the communities in the study area and their anchor institutions (government offices, fire districts, police, ambulances, schools, libraries and medical facilities) is estimated at $9.2 Million. These capital costs were broken down to effectively leverage grant funding available from the Rural Healthcare Grant program that would pay for 65% of the capital costs between medical facilities and hospitals and the Department of Local Affairs (DOLA) grant program that may pay for 50% of capital costs. For a detailed description of the capital costs and the grant programs, see Section 6 of this deliverable.

Section 1 – Market Assessment, Existing Services and Pricing

Local Service Provider Capabilities

In addition to community outreach meetings, NEO conducted individual interviews with the local service providers currently providing Internet services in the community.

According to Broadband Map USA[1], **CenturyLink** provides Asymmetric xDSL broadband technologies to 75% of the population in Teller and western El Paso Counties. The most common advertised download speed is 768 – 1.5 Mbps. The most common advertised upload speed is 200 – 768. This is well below the FCC's standard definition of 25 Mbps download and 3 Mbps upload speeds.

CenturyLink was awarded $26 Million in annual grant funding per year for six years in Colorado through the federal high-cost program. The federal universal service high-cost program (also known as the Connect America Fund) is designed to ensure that consumers in rural, insular, and high-cost areas have access to modern communications networks capable of providing voice and broadband service, both fixed and mobile, at rates that are reasonably comparable to those in urban areas. The program fulfills this universal service goal by allowing eligible carriers who serve these areas to recover some of their costs from the federal Universal Service Fund.[2]. Of the $26 Million annually, from the federal Connect America Fund II, $181,489 is allocated annually for six years for parts of Teller County (for a total of $1,086,000 in grant funding for the six years) to serve 426 households. El Paso County will receive a total of $751,666 annually ($4.5 Million) for 1,645 households.

The goal of the Connect America Funding is to make infrastructure improvements to bring unserved and underserved areas to 10 Mbps in download availability and 1 Mbps in upload availability. Although this program will help some areas within El Paso and Teller County, this program is more of a stop-gap measure than a good long-term plan.

[1] See http://www.broadbandmap.gov/
[2] See https://www.fcc.gov/general/universal-service-high-cost-areas-connect-america-fund

NEO Connect met with the CEO of **Peak Internet**, Jayson Baker, CEO, to discuss their plans to bring more robust broadband service to the area. According to the company's CEO, Peak Internet is investing in Fiber to the Home (FTTH) technology primarily for the Woodland Park community.

Peak Internet was founded in 2002 and primarily offered wireless Internet services. It relaunched in 2008 with aggressive plans to extend fiber throughout Woodland Park. According to Baker, the company is currently approximately 18-24 months from completing their initial fiber build within Woodland Park's city limits. Peak began building fiber from Colorado Springs to Woodland Park, but hasn't yet finished the build. Peak Internet, as mentioned previously, may be a good potential partners for completing this build. They may be willing to invest in the route and would most likely be willing to lease space in the conduit or provide additional capital to own fiber on this route rather than leasing dark fiber from the Counties.

In addition to Peak's fiber optic build, Peak continues to expand and upgrade its wireless network. They have wireless access points on many of the existing tower facilities throughout Teller County and continue to install repeater sites to expand their services.

The company stated that working to create more favorable rights-of-way policies and other ordinances to facilitate more fiber and wireless expansion is important. With fiber from Colorado Springs to Woodland Park, they would be interested in offering services to El Paso County communities. They are also interested in responding to future Requests for Proposals for construction of fiber networks and potential Public-Private Partnerships.

TDS purchased Baja Networks in Teller County and is offering cable TV services, phone and internet services. TDS stated an interest in fiber expansion to Colorado Springs and to/between the various communities and should also be considered a potential partner in future build opportunities. Their network is a hybrid cable coax network. They do not have plans to upgrade their network in Teller County to DOCSIS 3.1.

Comcast is the cable franchise provider in western El Paso County. Although Comcast is not serving Teller County, the company serves Park County and also stated an interest in joint participation in fiber expansion.

CenturyLink, Comcast and TDS have invested in limited fiber optic infrastructure to key businesses and anchor tenants within the communities. Their existing provider's networks are

based upon cable modem and Digital Subscriber Line (DSL). Each of these network technologies are shared; meaning, as more users are on the network, the capacity and availability of bandwidth is diminished. DSL service is provided by copper telecommunication lines and can carry high bandwidth signals only for a short distance – a few hundred yards; after which the signal is degraded and bandwidth diminishes. While cable modems generally provide transmission speeds of anywhere between five and 50 megabits per second on the download (and are generally much slower when uploading), this technology is shared and therefore, all users on the network share this bandwidth. For example, if there are 100 users sharing 50 Mbps, each user receives 0.5 Mbps of service.

Peak Internet's fiber optic technology provides two-way speeds of up to 1 Gigabit per second, with 10 Gigabit systems now coming to market. This is 1,000 times to 10,000 times faster than DSL, wireless and cable modem networks. Additionally, the carrying capacity of fiber is unlimited. As fiber optic technology transmit pulses of light, more bandwidth can be delivered on a fiber optic network by adding various colors of light or additional spectrum. Fiber is unique because it can carry high bandwidth signals over long distances without signal or bandwidth degradation and it can provide that capacity in both directions – for both upload and downloading information.

Section 2 – Identification of Key Assets and Partners

In addition to meeting with the primary service providers within both counties, NEO also reached out to other entities that might have assets in place today or may be potential partners for fiber expansion projects in the future. Key potential partners identified in this process are CDOT, Black Hills Energy and Intermountain Rural Electric Association (IREA). CDOT also has planned to build fiber from Colorado Springs to Woodland Park and is a potential partner in this effort. Both Black Hills Energy and IREA also are building fiber between their substations but do not currently have fiber infrastructure in place today. Colorado Springs Utilities is also interested in these discussions of infrastructure expansion and have fiber up Ute Pass from Colorado Springs, but it does not yet reach Woodland Park. Colorado Springs Utilities would like to have fiber extended further up the pass as well.

Tower facility inventories and plans for use of these assets will be discussed in the companion report to follow.

Section 3 – Survey Results and Community Engagement

NEO Connect conducted community meetings to speak with citizens about their needs as well as bring groups up-to-speed on Teller and El Paso County's efforts and aspirational goals around broadband. These meetings included:

- Monday, Nov 30, 1:30 pm at the CCV High School cafeteria with high school students
- Monday, Nov 30, 5:30pm at CCV High School cafeteria
- Tuesday, Dec 1, 9:00am LTPT Meeting
- Tuesday, Dec 1, 7:00pm at Ute Pass Cultural Center in Woodland Park
- Wednesday, Dec 2, 2:00pm at the Florissant Public Library.

Students Need Better Broadband for Education

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Students at Cripple Creek High School need to stagger taking online testing as there is not enough bandwidth for all students to take the tests at the same time.

Students that participated in the outreach meeting on Monday, November 30th were not encouraged by prospects of staying within Teller County post high school or college graduation as their almost universal perspective is that business/job opportunities are lacking in Teller County's current business environment. With any community, it is imperative not only to attract new residents and taxpayers, but keep citizens from moving out. Better broadband services could serve as a key component to innovation, jobs, and the economic opportunities that will keep Teller County's youth home.

Students are not able to effectively or efficiently take online tests, as there currently is not sufficient bandwidth for all students to take the online tests at the same time. Student testing is staggered throughout a week for online testing.

Other feedback from the communities included the lack of bandwidth available in more remote or less populated areas of the county. Florissant, for example, currently primarily relies on satellite broadband which is severely lacking in bandwidth availability.

Surveys

NEO Connect fielded two surveys to obtain input from both the residential and business communities in regards to Teller County's broadband needs. One hundred ninety-five survey responses were received for the survey targeting households while thirty-four responses were received for the business and anchor institution survey. On the surface, 34 completions for the survey targeting organizations may seem low but given the smaller number of sample to pull from, we feel this provides good directional insights.

When asked if respondents would be interested in accessing a faster, more reliable broadband network, 94% said, "Yes."

The survey asked and provided instructions to respondents to take an actual Internet speed test. The lowest speeds recorded were .31 Mbps download and .17 Mbps upload. The highest speeds recorded were 99 Mbps download and 97 Mbps upload.

More importantly, the **average speeds recorded were 8 Mbps download and 1.7 Mbps upload**. This is well below the FCC's new definition of broadband. In January of 2015, the FCC voted to change the definition of broadband by raising the minimum download speeds from 4 Mbps to 25 Mbps. Ninety-five percent of the speed tests recorded through the surveys were below the FCC's new definition of minimum broadband download speeds of 25 Mbps.

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Although the survey is a randomized sample, the results of the survey strongly suggest the following key takeaways:

- Speed, redundancy and price are what matters most to the respondents to the survey

- The community wants to see faster, more abundant broadband services
- The actual speed tests confirm the lack of adequate broadband services throughout the community

What follows are the complete survey results.

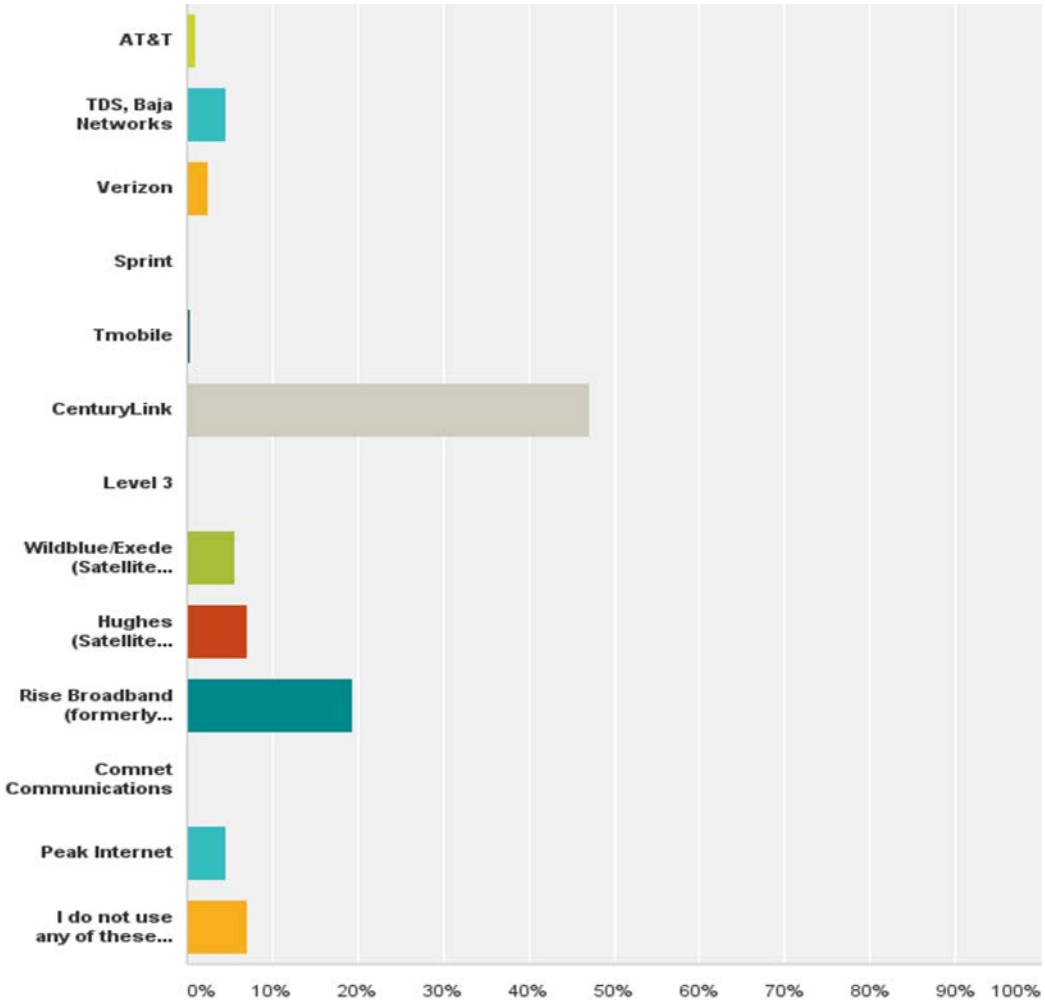
Residential Survey Results

Network Technology. Most of the respondents have DSL Service (42.05%) followed by 21.03% with satellite and 16.92% with wireless service as their home Internet service. The number of satellite users is proportionally higher than most other broadband surveys conducted throughout the state of Colorado.

Answer Choices	Responses	
DSL	**42.05%**	82
Dial-up	**1.03%**	2
Cable	**6.67%**	13
Satellite	**21.03%**	41
Wireless	**16.92%**	33
Mobile Phone Wireless, Cellular	**3.59%**	7
T-1 Service	**0.00%**	0
Fiber connection	**1.03%**	2
I don't have Internet service at my home.	**3.59%**	7
I do not know what type of connection I have at my home.	**4.10%**	8
Total		**195**

Reliability. When asked about reliability of the Internet connection, nearly half (43.78%) of the respondents stated that their connection speed varies considerably and the connection regularly drops. More than a third (36.76%) said the speed of their connection varies from time to time, but the connection never drops. Almost 10% stated that the Internet connection is very reliable and the connection never drops.

Answer Choices	Responses	
Very reliable, the connection never drops	9.73%	18
Speed varies from time to time, but the connection never drops	36.76%	68
Speed varies considerably and the connection regularly drops	43.78%	81
Very poor connection, which drops out all of the time	9.73%	18
Total		185



Service Providers. Nearly half (47%) have CenturyLink, 19% have Rise Broadband, and 7% have Hughes. It should be noted that this does not necessarily reflect the market share of Teller County; but rather, is representative of the respondents that took the survey.

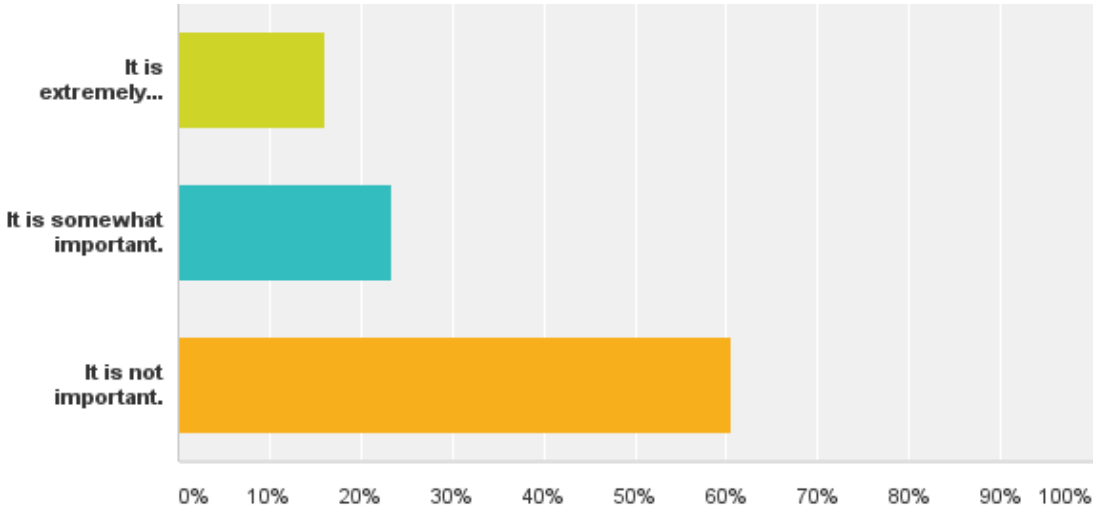
Current Pricing. Two in five respondents (42%) are paying $36 - $55 per month for Internet service while a third (33%) pay between $56 – 100 per month. Another 13% of the respondents are paying over $100 for Internet service.

The monthly costs for services shown above are sometimes inclusive of telephone service (31.55%) or TV service (11.76%), but most often, the cost just includes Internet service (62.57%).

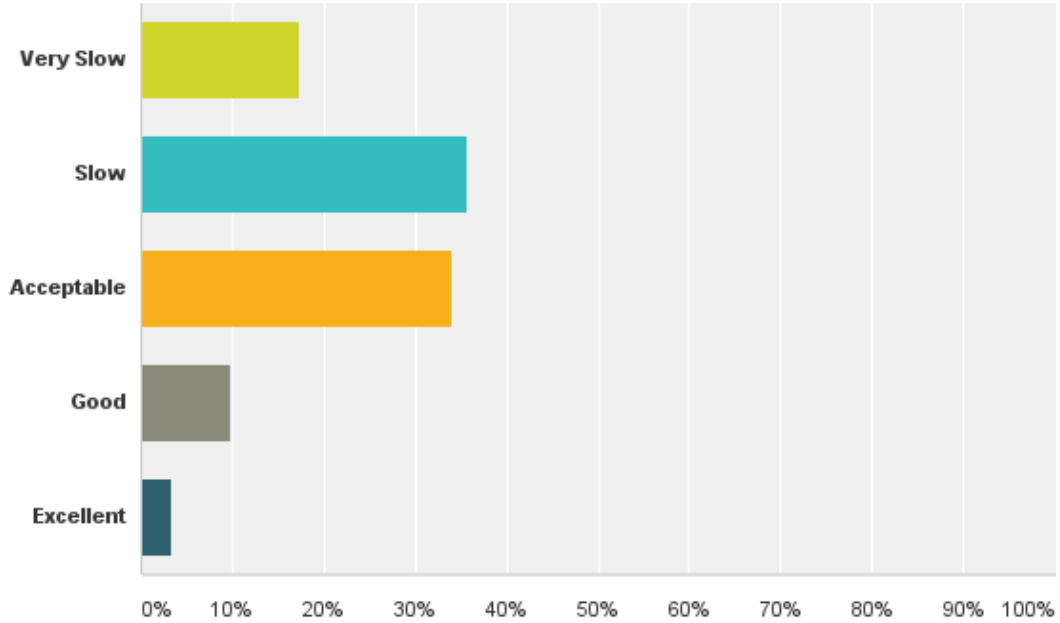
Answer Choices	Responses	
Yes, it includes my telephone service.	**31.55%**	59
Yes, it includes my TV service	**11.76%**	22
Yes, it includes my cell phone service	**5.35%**	10
No, the costs just include my Internet service.	**62.57%**	117
Total Respondents: 187		

Upon further analysis of the responses, all of the users that are paying more than $100 per month either bundle TV and Internet service or have "triple-play" service (bundling phone service, TV and Internet service.) In the responses that stated their bill only included Internet service, respondents fell on a wide range of paying $22 - $100 per month. More expensive service did not correlate with higher speeds.

Bundling Services. Nearly two-thirds (62%) of the respondents stated it was NOT important to that TV and phone service be bundled in one invoice with Internet services. The reaming respondents saw it as important as 16% stated it was "extremely important" to bundle service and 23% stated it was "somewhat important."



Perception of Speed. When asked to rate the speed of the Internet, many of the respondents stated that the Internet speed was good or acceptable. Some stated it was slow or very slow. Less than 4% of the respondents stated the speed was excellent. The primary take-away from the results of this question is that more education could be done within the County in regards to what is acceptable speed and perhaps what the rest of the world is experiencing in terms of speed.



According to the NTIA Broadband map, CenturyLink provides Asymmetric xDSL broadband technologies to a population of 17,159 (out of a total population of 22,752). The most common advertised download speed is 768 kbps – 1.5 Mbps. The most common advertised upload speed is 200 – 768 kbps. Approximately 75% of the population in Teller County has products that advertise this as the maximum speed available.

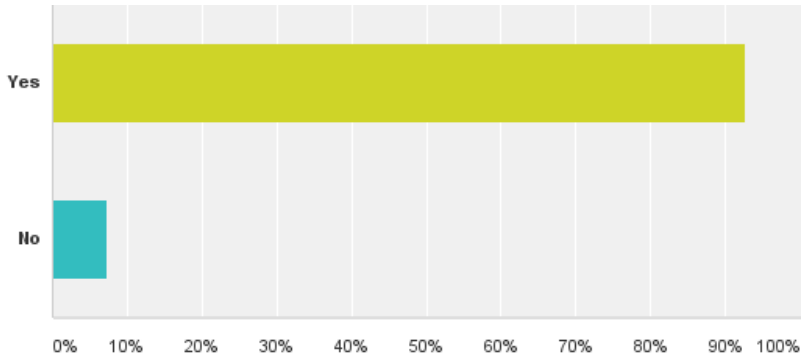
In January of 2015, the FCC voted to change the definition of broadband by raising the minimum download speeds from 4 Mbps to 25 Mbps. Three-fourths (73%) of the speed tests recorded through the surveys **did not meet the FCC's new definition of minimum broadband download speeds** of 25 Mbps.

Speed Test Results. The survey provided instructions to respondents to take an actual speed test. A majority of respondents (140 of 195) took the speed test and recorded the results. The number would have been higher but many responses to this question indicated that speeds were so slow that they were not able to take the speed test. The lowest speeds recorded were .31 Mbps download and .17 Mbps upload. The highest speeds recorded were 99 Mbps download and 97 Mbps upload.

The average speeds recorded were 8 Mbps download and 1.7 Mbps upload. Almost all (95%) of the speed tests recorded were below 25 Mbps in download speeds; only 5% of the respondents that took the speed test recorded speeds over the new FCC definition for broadband.

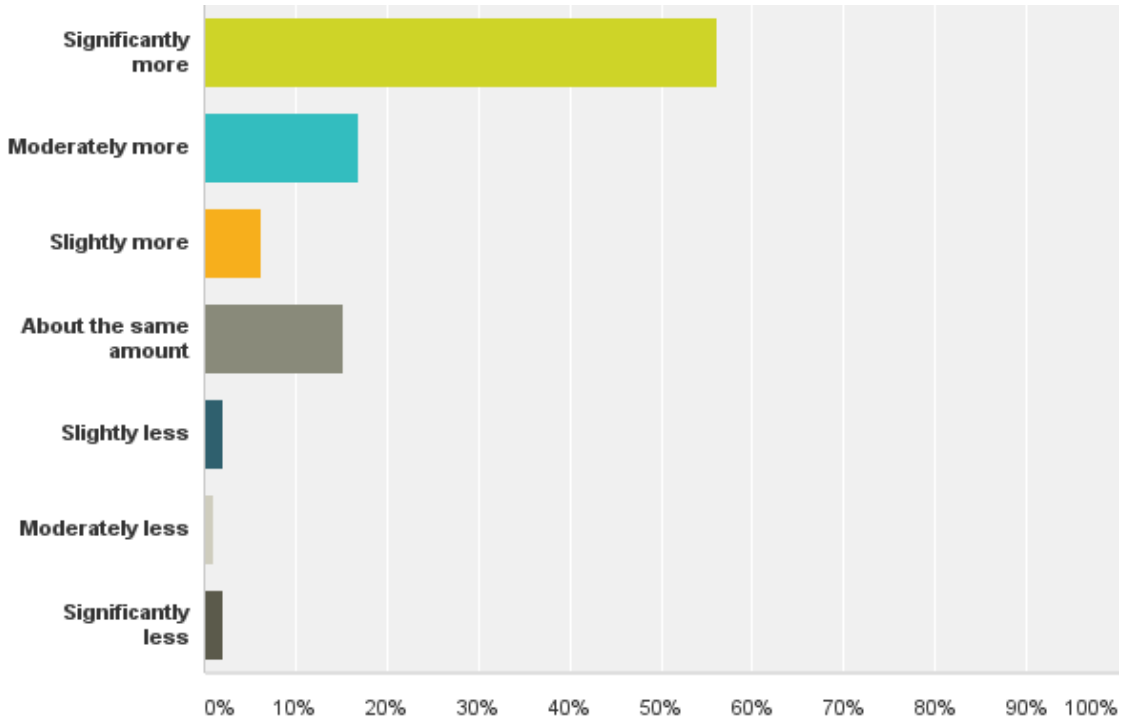
Time of Day Use. When asked what time of day is the Internet used the most at home, respondents answered during the evening and during the morning.

Answer Choices	Responses	
During the morning, between 6:00 a.m. and noon	**34.97%**	64
During the afternoon, between noon and 5:00 p.m.	**22.95%**	42
During the evening, after 5:00 p.m.	**42.08%**	77
Total		**183**

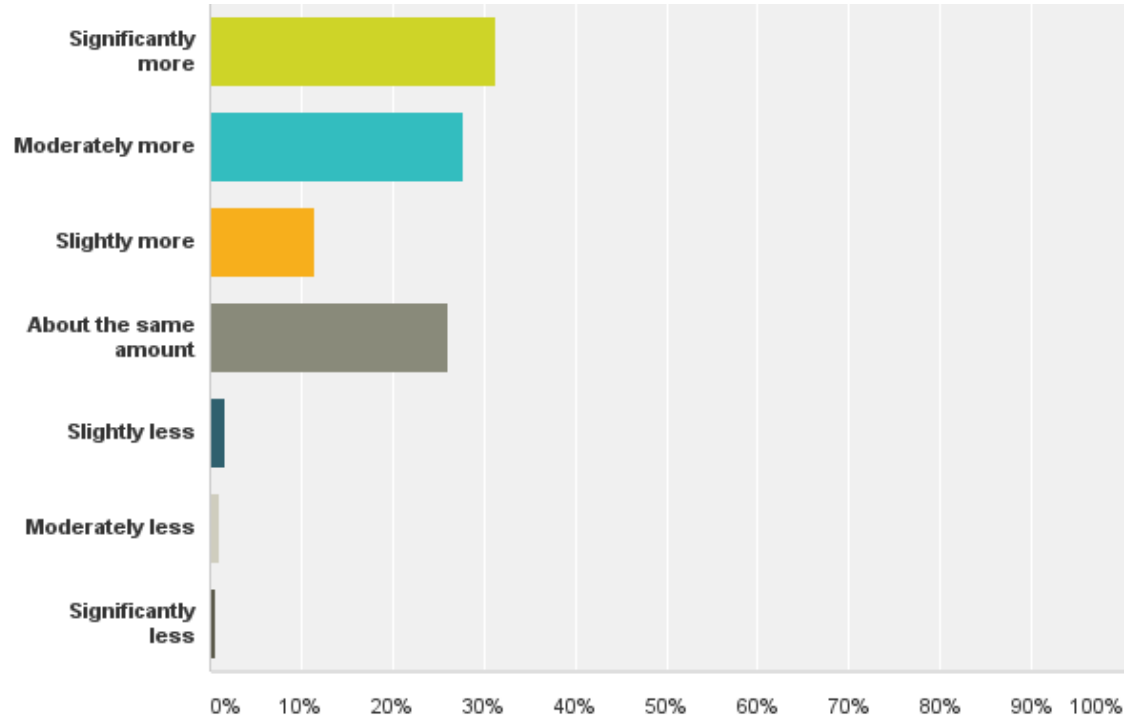


Interest. When asked if respondents would be interested in accessing a faster, more reliable broadband network, 93% said, "Yes."

Perception of Growing Use or Bandwidth Demand. Respondents were asked if they use the Internet more or less today than five years ago. Not surprisingly, most responded that the use the Internet significantly more than they did five years ago.



Respondents were then asked if they think they will use the Internet more in five years than they do today. Again, respondents thought they would use the Internet significantly more or moderately more. This leads to the question – how will Teller County meet increasing demands?



What Matters. Respondents were asked to rank what was the most important to them in terms of their Internet service with "1" being the most important. Respondents ranked "speed" as the most important attribute, followed by "redundancy" and then "price."

	1	2	3	4	5	Total	Score
Fast, I want speed and availability of abundant broadband	**55.48%** 86	**27.74%** 43	**12.90%** 20	**1.29%** 2	**2.58%** 4	155	4.32
Redundancy, I do not want my Internet service to be interrupted.	**25.16%** 40	**40.88%** 65	**20.13%** 32	**11.32%** 18	**2.52%** 4	159	3.75
Price, I want to pay a competitive price.	**20.37%** 33	**29.63%** 48	**43.21%** 70	**6.17%** 10	**0.62%** 1	162	3.63
Customer Service, I want a friendly voice and good customer support.	**7.23%** 12	**3.01%** 5	**14.46%** 24	**63.25%** 105	**12.05%** 20	166	2.30
Bundled invoice, I want one invoice for Internet, cable TV and/or phone service.	**7.26%** 13	**1.68%** 3	**7.26%** 13	**11.17%** 20	**72.63%** 130	179	1.60

Devices. The survey asked which devices were used to connect to the Internet and asked to check all the devices that apply.

Answer Choices	Responses	
Computer tablet	**67.19%**	129
Desktop computer	**65.63%**	126
Enterprise digital assistant (EDA)	**0.52%**	1
Laptop computer	**84.90%**	163
Personal digital assistant (PDA)	**4.17%**	8
Smart phone	**70.83%**	136
Smart TV	**30.73%**	59
DVD/DVR or Blue Ray Player	**32.29%**	62
Game Console	**16.67%**	32
Streaming TV (Apple TV, Roku, Netflix, etc.)	**42.71%**	82
Other (please specify)	**15.10%**	29
Total Respondents: 192		

Nearly a third (31%) of respondents stated they used a smart TV. Smart TVs require a minimum of 25 Mbps of bandwidth. Slightly more than two in five (42.71%) respondents use streaming TV and 70% use a smart phone.

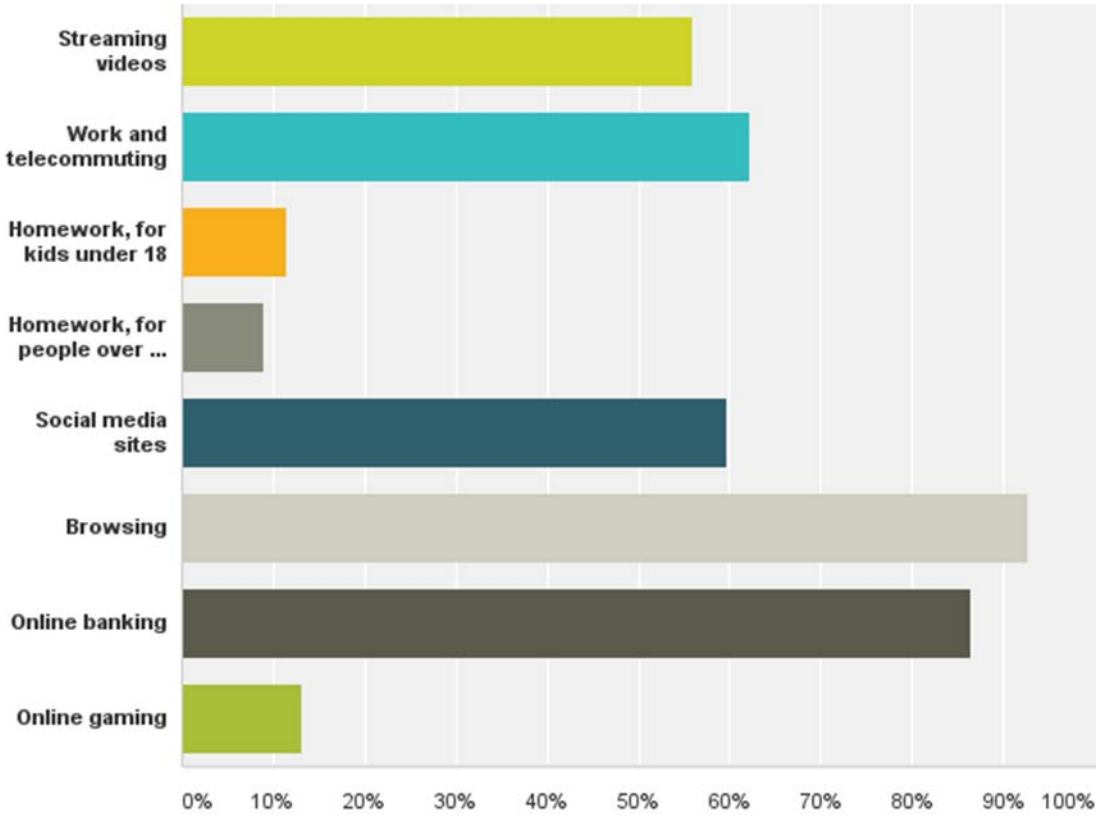
Work from Home. 50% of the respondents have either one or two people that work from home.

Answer Choices	Responses	
Yes, 1 person does	**39.06%**	75
Yes, 2 people do	**11.98%**	23
No	**48.96%**	94
Total		**192**

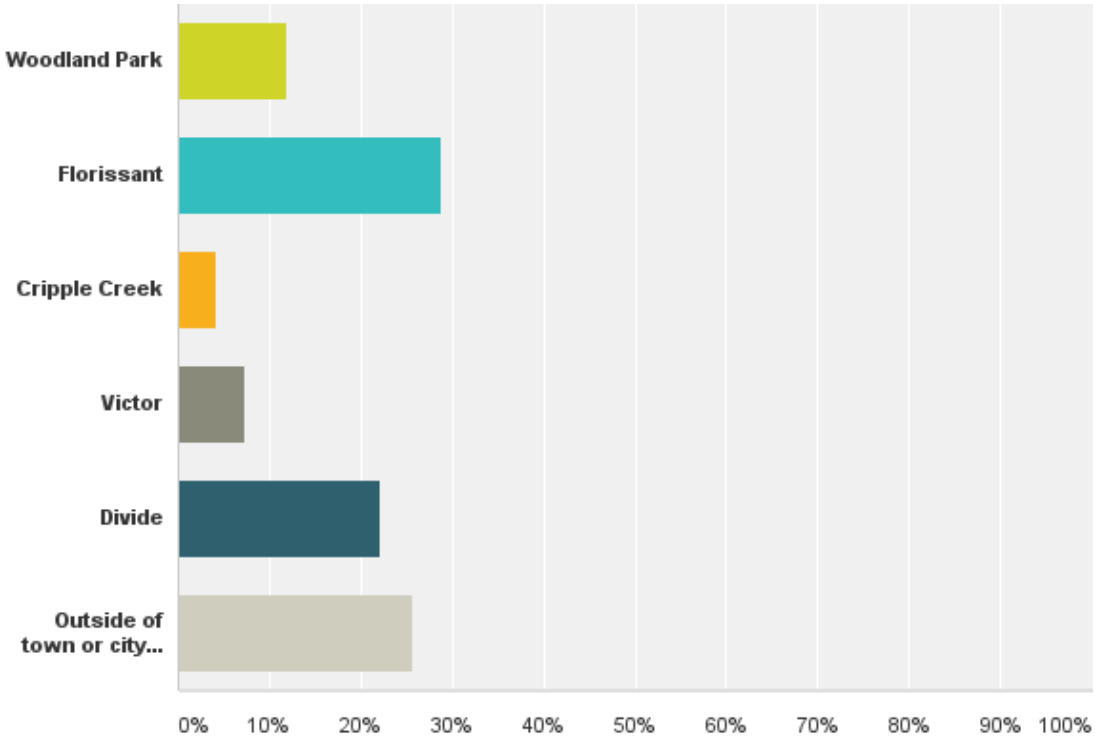
School-Aged Children. A large proportion (87%) of survey respondents do not have school-aged children living at home.

Answer Choices	Responses	
None	**87.11%**	169
1	**6.70%**	13
2	**5.15%**	10
3	**0.52%**	1
4	**0.00%**	0
5 or more	**0.52%**	1
Total		**194**

How is the Internet Used? The following uses of the Internet applied for survey respondents. Browsing and online banking topped the list, and 62% of the survey takers stated, "working from home and telecommuting."



The locations of respondents are shown below. It should be noted that residents who have slow Internet speeds and want to see something better could be more inclined to take the survey.



Open-Ended Feedback. Below are responses to the open-ended question, "If you have any other comments regarding your current Internet service or a community broadband service, please tell us below."

- Slower than it was 3 years ago. We have been in more remote towns that provide better service.
- My internet is so slow, the server stopped responding and I was unable to do the speed test, so I used another test for speed. Definitely need options for higher speed, but am concerned about services which have data limits, as they can be very expensive.
- The speed isn't too bad at the beginning of our billing period however after we use 10 Mbps the speed keeps slowing down until our next billing period. We are considering putting up an antenna to get line of site to a XXX microwave tower and hopefully some TV repeater signals. The hills and trees currently cause reception problems for internet, TV and cell reception.
- My Internet service is absolutely horrible. I pay an arm and a leg for the most awful service possible, and it is getting worse. It constantly cuts out, at least every few minutes. When it is "working," it is slower than you can possibly imagine. I am extremely frustrated that a better service is available to the more expensive houses in my neighborhood, i.e., lakeside, but it is not available to my house which is on the main street and in a main part of the neighborhood.

- I am on several Boards, and we communicate documents, etc. using the internet.
- I would like to have the ability to stream to my television, but service is too slow.
- Please. Please we need reliable fast internet service.
- We are part time residents, and not currently at our home in Teller County, so I used past speed test results - consistently under 1mb as we are at the end of the phone line where we live (CME).
- Cellular data/Wi-Fi is important to me to operate in the County with a smart phone.
- Because we are limited and speeds are limited, we do not stream television and do the least we can do at home. It makes it difficult to work from home.
- told by XXX repair there are 24 slots on our set-up, with 75 parties using it. XXX also told us they shouldn't even be sell the service here because they can't provide it. This, after XXX forced us to upgrade to a business account with a $40/month increase.
- It's supposed to be 1.5 Mbps but frequently I only get .1 to .2. On the plus side, when I moved here 1.5 years ago, it wasn't even available.
- good service just too slow to stream
- Videos are terrible. Do not run without many interruptions.
- Speed and reliability are the biggest issues. I use Wi-Fi for my business and can't afford not to be able to connect.
- I have DSL and therefore are not interested in broadband
- I really use the Internet throughout the day, so answer 10 just a very general one. Let's get Google Fiber involved!
- I have other devices that I cannot use due to my crappy slow internet connection...tablet, smartphone. Would use Netflix if I had a proper broadband. Having satellite or dialup as my only options is unacceptable.
- We are seasonal/ intermittent occupants of our house
- No streaming video due to slow speeds and buffering.
- Streaming services do not work because of the slowness of the XXX.
- A second provider option would be ideal. XXX is absolutely horrible.
- My service is interrupted at least twice a week, which means I must unplug my modem or wireless or both until it comes back on. There is only 1.5 mbps available here in Victor. We're on a fixed income (elderly) and really don't want to pay any more, no matter if the speed increases. Thanks, anyway. By the way, your last question should read "city" not "county." FYI
- No Broadband is not available in our neighborhood
- Just not fast enough to utilize what I could be - paying for services I can't use. Even simple videos won't download or take forever.
- Current service used to be excellent, but has gone downhill significantly in the last year. The tower must be oversubscribed. Rated speeds are better in the morning than in the evening. I pay for a 10Mbps service but receive less than 2 Mbps in the evening
- would like faster speed so I could try streaming movies, music, tv instead of paying high satellite programming costs. With my current 1.5 Mbps speed this is not possible

- It is artificial for me to separate work and home usage. it's like saying do you use your phone for work OR personal business. It's very mixed these days.
- please make it better
- It is the worse that I have ever seen!!!!!
- I will be moving to north Teller County, Turkey Rock Ranch. That area has NO cell phone service and NO Wi-Fi and NO option but satellite and land lines. That is Dark Ages. Probably means no streaming. I'd pay more to get coverage out there. I'd bundle if that would help. I have had Wi-Fi here for years now and I have NEVER gotten the speed I pay for! Never! Plus, their customer service has been awful. If there was a choice, I would not have XXX (maybe XXX will be better). Also, repeated buffering with streaming has become a problem the past year when it never was before. That may be a political problem but it is annoying. I have no idea if that is connected to this issue; sorry.
- I am paying for "up to" 20 mbps. Very often, the actual number I get is between 1 and 5 Mbps. A contemporary speed is extremely important to the entire household.
- based on FCC Guidelines - this is not Broadband!
- 3 Mbps DSL is fastest available in Divide and fine for my needs. If higher speeds were available to support movies delivered via Internet at a reasonable price we might consider signing up for such service. I only want to use wired service, not over the air. So faster DSL (phone line) or some other cable solution is what I would use.
- Occasionally the XXX (XXX) tower site has power problems, which takes our internet service down.
- Our broadband is based on 1980's technology. Pretty sad. Whole community would benefit from a comprehensive broadband improvement. Often we cannot download Netflix due to extremely slow speed. More often than not, cannot send large files due to poor speed and capacity.
- This is a mountain cabin; we visit typically during the spring - fall for a few days a couple of times a month.
- HELP...It SUCKS
- we need better cell phone service.
- A faster more reliable service would be nice with NO data caps. We use internet now for our TV watching and streaming music and do not want that limited as we refuse to pay prices for XXX or XXX. Note that question 15 will not hold my answer - the first 4 questions are ranked as a #1.
- We use the internet much of the day not just in the limits in question 10. Our connection will disappear if it storms, but we are close to the box and do not have the issues of others in our neighborhood. I find the cables not being buried ridiculous.
- We would like to be able to stream videos & movies & gaming, but our service is toooooo slow
- Any community broadband service must be open and not restricted by government in any way.
- my connection occasionally drops but is usually fixed very quickly
- goes offline sometimes when I need it most. VERY bad for my business.

- Reliable internet is one thing, but seeing my telephone cable dangling freely close to the ground and having the circuitry of the breaker box exposed is another. It would also be nice to finally get Optic Fiber or a higher speed.
- Thank you for working on this!
- Online anything is a drain to my data. I lived in the metropolitan areas with many choices. We suffer here because we are very rural and pay for substandard service in every aspect.
- About "What is most important to you regarding your Internet service?" - these cannot be absolutely ranked. Speed and a reliable connection go hand in hand. It is about availability of a minimum throughput. Right now at 7am, I am getting 5 Mbps - what I am paying for. Later this morning I will get 2 Mbps or less. That is an interruption of my contracted 5 Mbps speed. I have NEVER gotten a reliable throughput - it always fluctuates wildly due to over-subscription of the circuits. If I were to get at least 5Mpbs reliably, reliability would no longer the the #1 concern, speed would be. Once I was able to get 10-20 Mbps, then price or customer service would be the major concern. Right now, everything is a concern because I am not getting the speed I am paying for most of the time. About "When do you use Internet service the most?" - I work internationally, so I need work quality connectivity between 6am and 10 pm. In fact, the time we use the internet the most is pretty flat between 8am-10pm. I perform cloud backups in the early morning hours.
- We need competition here in the Highland Lakes subdivision. XXX does not offer reliable service at a competitive price. I would love to have XXX broadband up here.
- XXX does a pretty good job supplying phone and internet, pretty expensive but bundled phone much less than century link. Their customer service is very good; the phone service is sometimes temperamental but overall pretty reliable.
- Since XXX became XXX the service has improved slightly.
- It would be nice to have in the Aspen Hills Subdivision, outside of the Woodland Park City Limits in Teller County.
- There are no competitive rates when there is only one provider and no concern to upgrade our service.
- I would use more devices and more services, like streaming if I had the speed. It would improve my work if I had better speed.
- My service with XXX is VERY unreliable. Goes down all the time: I pay for 20 down and at best get 12 when no one else is on. When I want to watch streaming video at night often I can't even download a single movie.
- I am disgusted with my service--it goes out often and I do not get a credit for it. I have been considering a separate satellite for my internet. I also do not get cell phone service at my house
- It is unreliable, slow, and expensive for what I get. I usually exceed my monthly data allotment- 5 megabytes.
- Wish our service were more stable in terms of speed. Perhaps fiber would help.
- After complaining for a year XXX finally moved me to a new radio and am now getting close to 10 mbps whereas before I was getting less than 5 and in the evening I was getting 1.5 to 2.5 mbps.

- very poor reliability, not enough value for the price
- I do not want a bundle. I like paying for just internet.
- I live in a rural area. I use the internet for news, shopping, research, entertainment, etc.
- Work from home - HAVE TO HAVE reliable service
- 12Mbps is not even considered broadband by the FCC and yet I am paying for a "broadband" connection; overpriced for the lack of speed and connectivity.
- If this survey and speed test are a result of Teller co trying to initiate broadband, please be aware, many of know that it is much less expensive in other developed countries. Also, I am not willing to change providers without a really good incentive to do so. Thank you!
- Satellite service does not offer enough bandwidth for streaming.
- Question 10. I use the Internet 7 a.m. to 10 p.m. The choices are too limited.
- Due to proximity of switch gear, XXX is only able to provide "up to" 20Mb download, but I have never gotten higher than ~16Mb down and the max. upload is <1Mb which is not ideal for work environments requiring content upload. Peak internet does not offer fiber in my sub-division and their line of sight solution was unacceptable (reliability & consistent speed). XXX has no network redundancy and I was negatively impacted multiple times by that lack protection. I would welcome an alternative provider that has the ability to provide multiple levels of reliable service with capable 24 x 7 customer support.
- I wish to have a strong internet connection at a competitive price. 20 mbps is the strongest connection currently available out here.
- XXX is quite limited for watching internet stations, with only 20GB per month download. XXX was worse than the XXX dial up. I don't know the effect of modified sine wave electricity with EMI and RFI coming into the wires and within several feet of the inverters.
- It is absolutely crippling to have to use satellite internet--speed is slow, we are limited to how much we can use per month, we cannot stream videos as it eats up our monthly allotment, and the price is ridiculous. However, it is all we can get at our home, so we put up with it. We would be elated to have a viable alternative.
- XXX seems to be the only wireless provider with 4G service in the area, but when their signal drops to 3G it is not usable as a broadband service.
- XXX is unreliable and drops out, but it is the only available high-speed service available to me. XXX is the other available provider, but though they advertise high-speed service in my area (Spring Valley) their point-to-point high-speed service does not reach my house because I am in a low area near Burgess Reservoir. They regularly promote their increase of service through fiber optic to Woodland Park, but the outlying areas like Spring Valley do not receive any of this benefit.
- Would use internet to more if it was faster and had more bandwidth available. Whenever we have visitors, it gets used up really fast.
- It's hard to believe the USA has one of the slowest general internet broadband capabilities of most developed countries. more competition is necessary for providing low cost, high-speed broadband. Most, if not all, of the cable (copper or fiber) has been subsidized by public taxes, why shouldn't any new enterprise be allowed to use them without fees from the companies who laid the cable?

- BAD CUSTOMER SERVICE
- XXX -- great speed and service since infrastructure upgrade. XXX -- very poor, service often down. Peak Internet -- misrepresents product -- they say 90% coverage for WP, but they don't account for no service to homes with trees where they won't plan on adding fiber service.
- Recently switched to XXX & am pleased with speeds & service, with no outages. Pricing was a 1-year promotional deal; I think it's important to keep broadband service affordable, as it's becoming an essential utility, not a luxury. Fast, reliable broadband service is important to attract businesses and telecommuters to Teller County. I was a XXX customer until recently, and speeds were atrocious and inconsistent.
- Grandchildren spend considerable time at our home. We live in Fredericksburg, Texas and own a vacant lot in Cripple Creek.
- Switched from wireless because of interference of vegetation love the cable consistency and speed.
- It is very unreliable. Customer support is almost nonexistent. It is currently not working at this moment - I'm completing this survey on the road. More important to me than cost is reliability. I want it to work all the time, every time.
- service repairs are slow
- I live in Turkey rock estates and there are around 30 to 60 internet users here. Most would be willing to pay up to 100.00/month for broadband service!
- I am not interested in any additional fees of any kind.
- We should have the right and availability to fast internet service if we want it.
- PLEASE bring High Speed Internet to Rainbow Valley, Divide, CO.
- I have used satellite Internet, but it's too slow and the lag time is prohibitive. I am a support engineer for A large Software company and I have to rent an office in Woodland Park when I could be working from home. My address is 101 Wildcat Creek Drive. Phone number 7197481204 My name is Tim McMahan If I could get High Speed internet at home I would not have to drive 65 miles per day. I need High speed also because I Use Cisco Jabber and Cisco WebEx to do web conferences and connect to our customer's systems and review their issues. Please get high speed internet to my address and I will pay for the full package.
- the answers to 21 are what I attempt to do, mostly not successfully
- We live on Bluespruce in Divide and currently get no cell phone or internet reception but would be very interested in a reliable service at a reasonable price
- I can't wait for my contract to end with XXX so I can cancel without penalty. I would rather sit at McDonalds and use their Wi-Fi.
- I bought a XXX minimax booster or whatever that did not work due to tower issues. I shared my neighbor's XXX for 4 months until the browser or something stopped working. My XXX tablet does not get a connection at home and not a good one at free Wi-Fi available downtown Victor. Ok in Cripple Creek. XXX said they could not provide fast enough broadband to stream. XXX didn't know they had internet service in Victor (only DSL). I do NOT want cable TV nor do I wish to change phone provider from XXX. I go to Cripple Creek

to make most phone calls as I get mediocre reception at my home and NONE in downtown Victor.

- I can't get XXX internet service at my home. Have to drive to find a free Wi-Fi hotspot in order to use the internet. When I DO have access (not at home) I use for streaming videos, social media, browsing, online banking. Pretty frustrating to have no options other than dial-up at 24 Mbps. (next to worthless)
- I have XXX on my smart phone and cannot get the Internet unless I go to somewhere else in the subdivision
- XXX is the worst internet provider I have ever had. If there was another option, I would take it but XXX doesn't service here and XXX became too expensive.
- had I known it was going to be this bad I would have done without it
- I did not do the test because I was not at the residence when I responded
- So far the service I have has been ok. It could be a little faster, but I have the time, so not as important as it would be to someone who works out of their home.
- We are moving to an area which we know we will get better service and choices.
- I would like to be able to fax but phone line does not work well for calls and 10% of time for fax.
- I pay for 1.5 Mbps, rarely receive more than 1.0. This is the highest speed available through XXX for my area.
- They have gotten slower.

Business and Anchor Institution Survey Results

What follows are the results business and anchor institutions surveys.

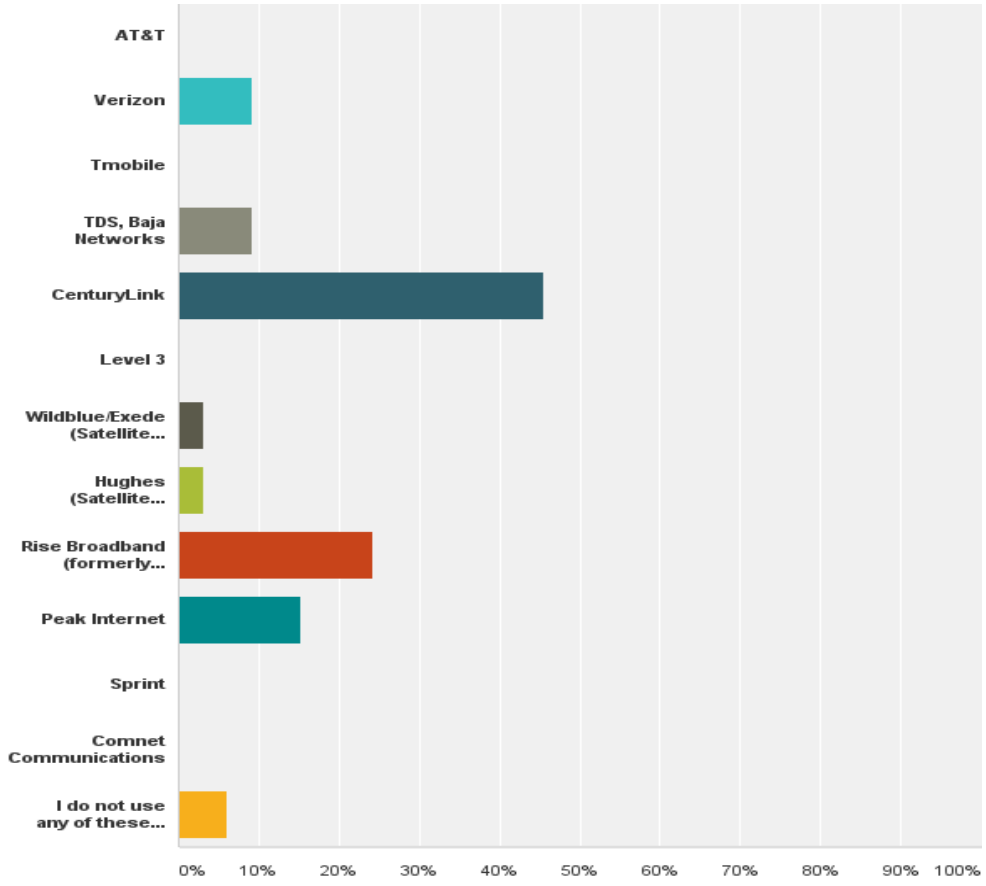
Network Technology. Currently 38% of the business respondents use DSL, followed by 29% using wireless, then cable modem service.

Answer Choices	Responses	
Dial up	**0.00%**	0
DSL	**38.24%**	13
Cable	**8.82%**	3
Satellite	**11.76%**	4
Wireless	**29.41%**	10
Mobile Phone Wireless, Cellular	**8.82%**	3
T-1 Service	**11.76%**	4
Fiber connection	**11.76%**	4
I don't have Internet service at my business.	**0.00%**	0
I do not know what type of connection I have at my business	**0.00%**	0
Total Respondents: 34		

Reliability. When asked about reliability of the Internet connection, 53% stated the speed varies considerably and the connection regularly drops. Almost 1/3 (29.4%) stated the speed varies from time to time, but the connection never drops.

Answer Choices	Responses	
Very reliable, the connection never drops	**11.76%**	4
Speed varies from time to time, but the connection never drops	**29.41%**	10
Speed varies considerably and the connection regularly drops	**52.94%**	18
Very poor connection, which drops out all of the time	**5.88%**	2
Total		**34**

Service Providers. Most of the respondents have CenturyLink, followed by Rise Broadband and Peak Internet. This is not necessarily representative of market share within Teller County, but simply based upon respondents' obtained.



Current Pricing. The range of what is currently being spent for Internet services varies for business users; most are paying between $50-$100, followed by a range of $100-$250.

Answer Choices	Responses	
Less than $50 per month	**19.35%**	6
Between $50 and $100	**38.71%**	12
Between $100 and $250	**35.48%**	11
Between $250 and $500	**0.00%**	0
Between $500 and $1000	**3.23%**	1
More than $1000	**3.23%**	1
Total		**31**

Many of the respondents stated that their costs included voice or phone service as well as Internet service.

Speed Test Results. The survey provided instructions to respondents to take an actual speed test. **The average speeds recorded were 21.68 Mbps download and 5.27 Mbps upload**. Four in five (79%) respondents test results were below 25 Mbps download. 4 of the respondents or 21% had test results over 25 Mbps download.

Why Haven't You Subscribed to Faster Internet? When asked, "What are the main reasons your business doesn't subscribe to a faster Internet service?" respondents primarily responded that faster Internet service is not available, followed by the monthly bill for faster Internet service would be too expensive.

Other concerns from the respondents were, "The business would be required to sign a contract to get faster Internet service," and "The business would have to purchase or lease equipment to get faster Internet service."

Would you Subscribe? When asked if the business would subscribe to Gigabit service if it were available, two thirds said they were likely to do so (39% very likely and 27.27% most likely).

Answer Choices	Responses	
Very likely	**39.39%**	13
Most likely	**27.27%**	9
Somewhat likely	**27.27%**	9
Not at all likely	**3.03%**	1
It would depend upon how much it costs.	**3.03%**	1
Total		**33**

Faster Internet Speed Impact. Businesses were asked if faster Internet speed was available, how the business would be impacted. Businesses were asked to check all that applied. Here were the results:

Answer Choices	Responses	
Internet is fast enough. The business would not do anything different if the Internet was faster.	15.15%	5
Conducting more business	51.52%	17
Hire more employees	6.06%	2
More with maintaining a database/record keeping	54.55%	18
More financial management/billing	24.24%	8
More email or other communications	45.45%	15
More videoconferencing	45.45%	15
More webinars or online training	51.52%	17
Connecting with similar businesses more	24.24%	8
Conducting more research	36.36%	12
Set up more locations	9.09%	3
Total Respondents: 33		

Most mentioned were "Conducting more business," "More with maintain a database/record keeping," "More email or other communications," "More videoconferencing," and "More webinars or online training."

Considered Moving? When prompted with: "I am considering moving my business outside of the Teller County area because I cannot get Internet that is fast enough to support my business," within the survey two respondents said, "Yes, I have considered moving my business." The bulk of the respondents (82%) stated they were staying in Teller County but wish for faster Internet. One respondent considered moving the business because of the Internet.

Answer Choices	Responses	
Yes, I have considered moving my business	3.03%	1
Yes, I am planning to move my business	0.00%	0
No, I am staying put but wish there was faster Internet	81.82%	27
No, I am staying put and my Internet is adequate to support my business	15.15%	5
Total		33

What's Important. Respondents were asked to rank what was the most important to them in terms of their Internet service with "1" being the most important. Similar to the residential survey, business respondents ranked "speed" as the most important attribute, followed by "redundancy" and "price."

	1	2	3	4	5	Total	Score
Fast, I want speed and availability of abundant broadband.	68.97% 20	20.69% 6	10.34% 3	0.00% 0	0.00% 0	29	4.59
Redundancy, I do not want my Internet service to be interrupted.	29.63% 8	37.04% 10	18.52% 5	3.70% 1	11.11% 3	27	3.70
Price, I want to pay a competitive price.	14.81% 4	40.74% 11	44.44% 12	0.00% 0	0.00% 0	27	3.70
Customer Service, I want a friendly voice and good customer support.	4.17% 1	4.17% 1	16.67% 4	62.50% 15	12.50% 3	24	2.25
Bundled invoice, I want one invoice for Internet, cable TV and/or phone service.	5.00% 1	10.00% 2	10.00% 2	20.00% 4	55.00% 11	20	1.90

Open-Ended Feedback. Below are responses to the open-ended question, "If you have any other comments regarding your current Internet service or a community broadband service, please tell us below."

- XXX is awful! Need more options!!!
- Too slow drops often

- I have to leave my home in Divide and go to a different location to get speeds fast enough to conduct business.
- My current provider has good service and a good price for their internet and voice packages.
- XXX provides very poor customer service
- We have recently been able to connect with XXX, which is an improvement, but faster speeds would still be better as we are beyond maxed out on bandwidth even without the campground full.
- XXX is working fine as long as we don't exceed allowed bandwidth for the month. Most of the time we don't. But when we do, it gets really slow.
- The service I have is reliable but the available download speed prohibits using it as a video download.
- Value added is important. internet security, Office suite, website and support. I hate it when it slows or drops!!!
- Internet connection at home is good, DSL. The cost of a hard line in the store is more than I can afford and the winter months aren't kind to merchants.
- XXX sucks!

Section 4 - Colorado Senate Bill 152

In 2005, the State of Colorado passed a bill that limits municipalities from building telecommunications infrastructure for end users (§ 29-27-101 to 304, C.R.S., commonly referred to as "SB-152".) This legislation is a barrier for Colorado communities in improving broadband capabilities and it limits the options for ownership and service delivery by municipalities, counties and local governments. The remedy for Teller county could/would be introducing a local referendum to overturn SB-152.

Should the county consider moving forward with such a referendum, it should be known that the

Opting Out of Senate Bill 152 Gives More Options

...

Government entities are currently restricted from building out telecommunications and broadband infrastructure for end users, and/or from entering into Public-Private Partnerships to help solve broadband gaps.

law generally requires an election before a local government may take various actions to provide Internet access service, cable television service, or telecommunications service to the public. The statute also requires "regulatory parity" between public and private providers of such services. Much of the statute concerns various exemptions from this requirement. For example, SB-152 provides that the law does not limit the authority of local governments to enter into agreements permitting private telecommunication service providers to lease space on government property for the placement of telecommunications equipment. Arrangements between municipalities and private telecommunication providers for placement of equipment such as cell phone antenna arrays are common. With this provision, no election is required in connection with such agreements. The statute also does not apply to government provision of various telecommunication service to citizens for governmental or intergovernmental purposes, including for use by persons "accessing government services." Governments commonly provide a variety of telecommunication services to citizens using its buildings and facilities; no election is required for this to continue. Furthermore, SB-152 makes clear that no election is required in order for governments to operate internal communications networks and to utilize such networks in cooperation with other governmental entities. Should local governments wish to sell insubstantial amounts of "excess capacity" on their networks, they may do so without an election, provided that the sale and use is made on an evenhanded, "competitively neutral" and "nondiscriminatory" basis.[3]

NEO Connect engaged Ken Fellman, a Colorado-based attorney with Kissinger & Fellman to provide feedback on the impact of SB-152. An opinion letter was provided by Fellman discussing various questions regarding subscriber definition, limitations, ballot questions and service delivery models. Below are a few highlights of Fellman's findings.

Under SB-152 there is a prohibition of providing services specifically noted as the provision of services to "subscribers." In the statutory definition, there is a specific exclusion that indicates that a government's provision of services to other governments is not considered as providing service to a "subscriber." The specific statutory language reads as follows:

> (5) "Subscriber" means a person that lawfully receives cable television service, telecommunications service, or advanced service. ***A person that utilizes cable television service, telecommunications service, or advanced service provided by a local government for local governmental or intergovernmental purposes and is used by***

[3] Geoff Wilson, Colorado Municipal League General Council brief of SB-152.

> ***persons accessing government services is not a subscriber for purposes of this article.*** (emphasis added) C.R.S. § 29-27-102.

Therefore, a government network may provide services to other governmental and quasi-governmental entities, without seeking voter approval, as it would have to do if it wished to provide services to non-governmental entities.

> CRS § 29-27-102(1) defines "advanced service" as "high-speed internet access capability in excess of two hundred fifty-six kilobits per second both upstream and downstream." This definition is out of date, and not reflective of today's technology. Any service that can deliver data speeds over 256 kbps would, in Fellman's opinion, be considered "advanced service" under SB-152.

A local government can build any kind of a communications network, and can, without other authority, provide all of the services identified in this plan, but only to itself or other governmental/quasi-governmental entities. All of the services mentioned within this broadband blueprint would be considered advanced services if they are delivered at speeds in excess of 256 kbps. A government that has built a government network cannot expand and provide service directly to subscribers (as that term is defined in the statute) without voter approval, unless it comes under one of the limited statutory exceptions. One of the exceptions states that:

> *Nothing in this article shall be construed to apply to the sale or lease by a local government to private providers of excess capacity, if:*
>
> *(a) Such excess capacity is insubstantial in relation to the capacity utilized by the local government for its own purposes; and*
>
> *(b) The opportunity to purchase and the opportunity to use such excess capacity is made available to any private provider in a nondiscriminatory, nonexclusive, and competitively neutral manner.*
>
> CRS § 29-27-302(3).

While this inexplicable limitation is in place, it is by no means insurmountable. Local governments can obtain exemption through a local ballot initiative to opt-out of SB-152. As of April 2016, approximately 60 municipalities, counties and school districts have held public elections to opt out of SB-152. All of the favorable opt outs have passed overwhelmingly. Some communities (Estes Park, Durango and Telluride) passed with over 90% voting in favor of

opting out of this restrictive bill, giving local governments the authority to solve broadband infrastructure gaps within their communities.

Out of Date

The fact that SB-152 was written into law in 2005 is evident in in that it defines high-speed Internet as 256 kbps, versus current standards defining broadband as 25 Mbps download speed and 3 Mbps upload speed. The good news is that municipalities can indeed offer free Internet service in city libraries, parks and community centers. The bad news is that it cannot exceed service speeds of 256 kbps.

The bigger issue with the 2005 legislation is that it assumes that the private sector will provide adequate service – services that are good enough for businesses to compete and its citizens to thrive. As economic development is not (nor should it be) a top priority for private carriers or part of their own business case, many towns are under or unserved, requiring municipalities to build (or partner to build) a modern infrastructure.

How to Proceed

A simple yes or no referendum to secure voter approval allows a Colorado, town, city, county, etc. to move forward with their broadband aspirations. This includes investing in infrastructure as well as forging partnerships to deliver alternative broadband service

What an Opt Out Means

An opt-out from your voters puts the authority to decide next steps in the hands of local authorities. Communities can conduct a feasibility study to see what better broadband in their community would cost and what it could mean in terms of economic and social advancement. Local authorities can look into potential public-private partnerships or even sit down to negotiate with the region's current Internet providers. Local authorities can build infrastructure and provide broadband services to the public if desired.

Aspirations Differ

Most often towns that seek to opt out of SB-152 as merely step one in exploring options and determining the appropriate level of investment to meet community aspirations. Aspirations could be as grand as building your own network or as simple as a negotiating tool with private carriers. Many towns that "opt out" have no desire to build or manage a network, but they do want the freedom to do so if it is their only option. Opting out gives your community options.

Colorado Opt Outs

As of April 2016, more than 60 communities have opted out of SB-152 since November 2015, with an average "yes" vote to opt out coming in at 80%. The vast majority of local governments who have opted out are not decided on providing broadband services themselves; they are merely serving their constituents by recognizing current gaps in service. How these challenges are addressed is a question for planning, strategies, negotiations, asset assessment, public-private partnership meetings, etc. With so many communities opting out, many are uncovering opportunities to work together, aggregate demand and share costs.

Ballot Initiative Example

The following is an example of what a ballot initiative would look like:

"Without increasing taxes, shall (insert different government entities) have the legal ability to provide any and all services currently restricted by Title 29, Article 27, Part 1, of the Colorado Revised Statutes, specifically described as "advanced service," "telecommunications services" and "cable television services," as defined by the statute, specifically including new and improved bandwidth services based on best available technologies, utilizing current and new community-owned infrastructure to any existing fiber optic network, either directly, or indirectly with public or private sector service providers, to potential subscribers that may include telecommunications service providers, and residential or commercial users within (government entity), and that said services may be provided by (government entity) alone or in partnership with other governmental, private or corporate, including nonprofit, entities?

Section 5 – Broadband Friendly Policies and Ordinances

NEO recommends putting in place broadband friendly policies and ordinances to encourage further broadband infrastructure deployment by helping to reduce the capital costs of fiber builds. These policies also encourage the following:

1. Reduce the cost of construction for broadband networks. 60-80% of a fiber optic network's capital costs are in opening a trench or in burying conduit that will house fiber optic cable. Policies that encourage placement of fiber in coordination with other City capital projects (sidewalks, trails, lighting, and road widening projects) and coordination with other utility projects by others - may all be opportunities to install conduit.

NEO recommends implementation of a ***Dig Once Policy*** that has the following components:

All public works or installation of other telecom, cable or utility infrastructure allows for conduit to be placed on behalf of the City and any other entities that want to participate. If there is an open trench, the policy provides for coordination of street cuts and excavations with utilities, public works, developers and other interested parties to maximize the opportunity for broadband conduit installation, and to minimize cost, disruption and damage.

Allows for a notice period informing other entities that an open trench will be available for placement of their conduit and/or fiber optic facilities

Allows for shadow conduit to be placed for the Town, City or County. Installation of empty and/or space conduit by a public agency when excavations occur in the public right of way, with agency (Town, City or County) costs limited to incremental costs.

Additionally, NEO recommends that the various government agencies establish ***Joint Trench Agreements*** and ***Joint Build Agreement***s with other telecommunications, cable or utility providers. Cost for placement of conduit or fiber will be shared amongst all entities, allowing each entity to take advantage of trenches that have been opened through each other projects and allows for sharing of capital costs for any conduit and/or fiber builds. Standardization of these agreements across all potential owners of underground infrastructure can be established to ensure all parties are aware of the joint trenching opportunities as they become available.

NEO also recommends a ***Streamlined Permitting Process*** – placing responsibility for approval of broadband infrastructure projects solely in the public works department via encroachment permit processes. An ***Abandoned Fiber and Conduit Policy*** can be put in place if any abandoned fiber and/or conduit that are not claimed by the owner within a reasonable time period, the ownership of that conduit and/or fiber would revert to the local government agency.

2. Encourage standards for placement of conduit and/or fiber in new developments.
Integrating broadband "utility" codes into land development policies and city ordinances to ensure that new real estate developments incorporate a standard placement of conduit and/or fiber optic facilities. The land development codes could require new land developments, new real estate developments and/or newly built homes and office buildings to install fiber optic infrastructure. New building codes could describe specific compatible communications components and architectures into each new building, and could describe development and use

of City/County right-of-ways for communications connectivity, and could specify standardized specific wiring requirements for new buildings.

3. Set up funding mechanisms to allow for adoption of these policies. Conduit is not expensive. However, if the funding mechanism does not exist to place conduit, often opportunities to take advantage of open trenches or joint builds do not occur. A funding set-aside or budget process must be put in place to allow for adoption of these policies. The funding mechanism will allocate monies to build broadband infrastructure when opportunities arise and the fund would maintain a reserve or set-aside for unanticipated projects.

4. Keep a GIS database of all infrastructure, and provide for a process to submit plans. Any permit for work done within the right-of-way or for new developments would require as-built drawings to be submitted to routinely document conduit and other broadband asset data into a geographic information system. The policy could establish a requirement that plans and as-built drawings and other information be submitted by utilities, developers, contractors and others in an appropriate GIS format.

NEO provided sample policy and ordinance language that other communities have implemented for all of the above policy recommendations. NEO also provided information regarding compliance with the FCC Order on Mandatory Wireless Facilities Collocation.

Section 6 – Building Middle Mile, Anchor Routes by Leveraging Partnerships. Discussion on Financing and Funding

This section lays the groundwork for the implementation plan, NEO's methodology for the preliminary design and projected capital costs, information regarding partnership and grant funding.

Providing Redundancy and Options for Service Providers, Middle Mile Transport to Colorado Springs

NEO put together a preliminary design and capital cost estimates for connecting the communities. Bringing fiber to each of the communities aggregates demand and reduces costs for broadband services, as the costs for the services are shared amongst all of the users. Also, once fiber is brought to a community, it is relatively less expensive to expand this fiber within the community to other key locations and anchor institutions.

Connecting Anchor Institutions

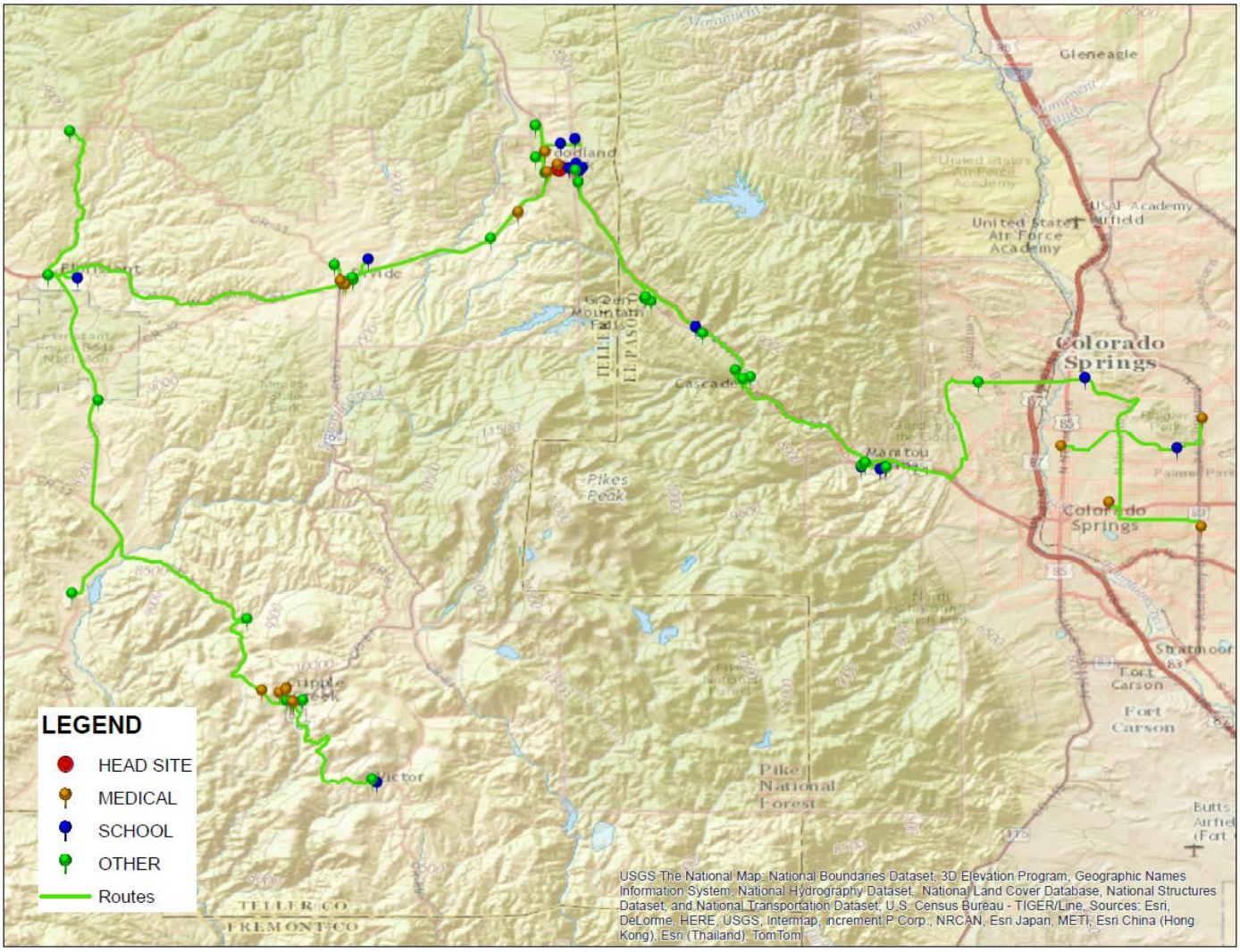
NEO and the LTPT put together a list of community anchor institutions made up of schools, city and county locations, medical facilities and clinics, and libraries. A GIS map of the proposed design was provided to Teller and El Paso County as a deliverable of this project.

Building fiber to the anchor institutions allows for the ability to offer 1 Gbps service to the anchor institutions. More importantly, building fiber to the anchor institutions allows this project to leverage several grants to fund the builds. For example, the Rural Healthcare Fund grant and the E-rate Program for schools will provide funding to pay for 65% of the capital costs for the middle mile portion of the build – the most expensive part in building to the other communities within the Counties.

Additionally, building fiber to the anchor institutions by leveraging grant funding gives needed fiber connectivity to the smaller communities within the Counties. Once fiber is built to these communities, wireless access points may be installed at the anchor institutions in each of these communities. Wireless bandwidth is enhanced when it is fed with fiber. Wireless broadband could then be used to further expand and enhance broadband services to homes and businesses in these communities.

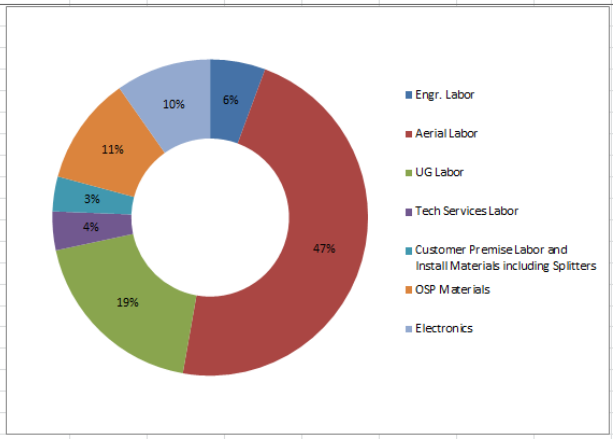
A list of all anchor institutions (government offices, fire districts, police, ambulances, schools, libraries and medical facilities) has been provided to Teller and El Paso County representatives. On the next page is a map of the proposed routes to connect the various anchor institutions and the communities with fiber.

Teller and Western El Paso Counties Routing – All Anchor Tenants



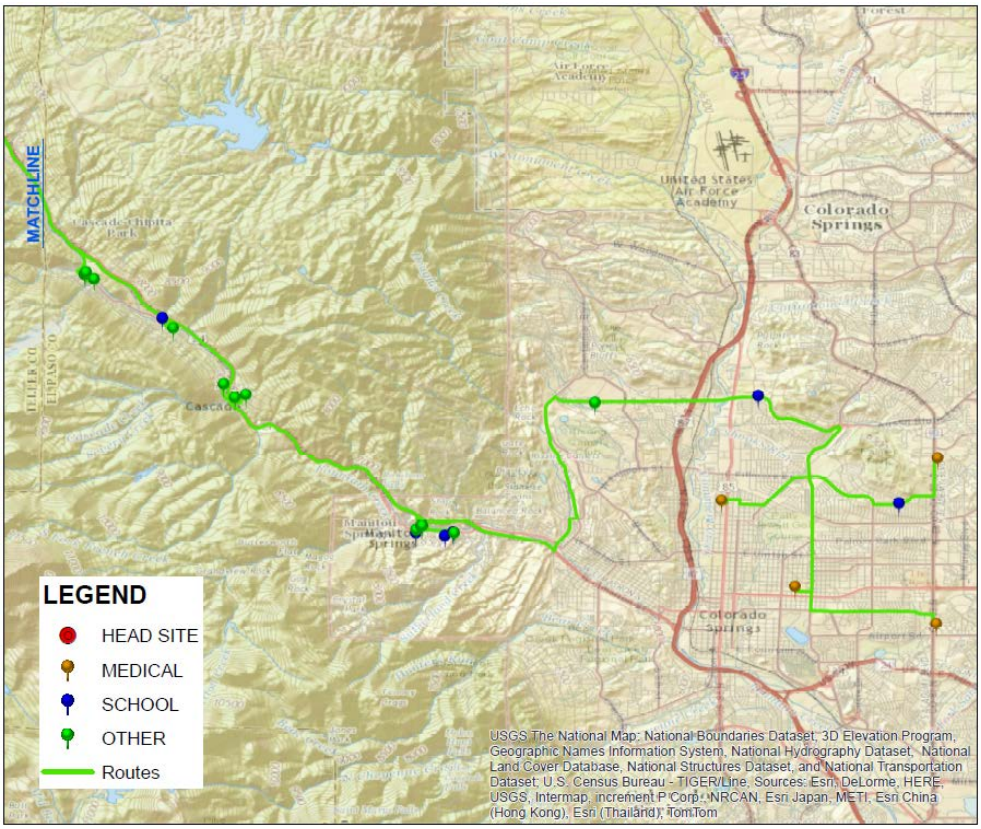
Below are the assumptions and estimated capital costs for all of the anchor institutions within Teller and western El Paso Counties.

Estimate Dashboard				
Major Assumptions	Values			Middle Mile
# Parcels/Passings	0	Overall	Project Cost	$9,257,960
Middle Mile Connections	98		Cost per HHP	NA
# Poles	2388		Cost per HHS	NA
Est. Aerial Miles	77		Cost per MI	$96,336.73
Est. UG Miles	19			
Aerial %	80%	Engr. Labor	Project Cost	$524,256
UG %	20%			
Density HH/Mile	-	Aerial Labor	Project Cost	$4,361,613
Take Rate	100%			
Make Ready Cost per mile (all in labor only)	$ 39,455.58	UG Labor	Project Cost	$1,748,262
ADSS or Strand/Lash	Strand/Lash			
Missile Bore/Open Trench %	10%	Tech Services Labor	Project Cost	$366,754
Directional Bore %	90%			
Plow %	0%	Customer Premise Labor and Install Materials including Splitters	Project Cost	$330,221
LD Downtown %	0%			
HD Downtown %	0%			
Rock Adder %	40%			
Cut/Restore %	2%	OSP Materials	Project Cost	$1,023,626
Make Ready Construction	yes			
OLT Equipment	yes	Electronics	Project Cost	$903,228



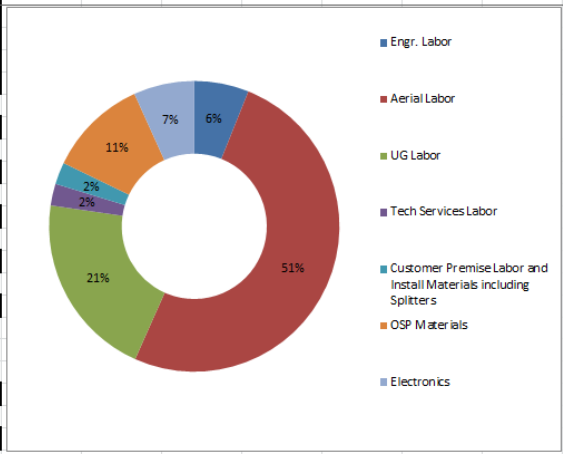
The following provides the routes and estimated capital costs broken down for western El Paso County only:

Western El Paso Co Routing – All Anchor Tenants



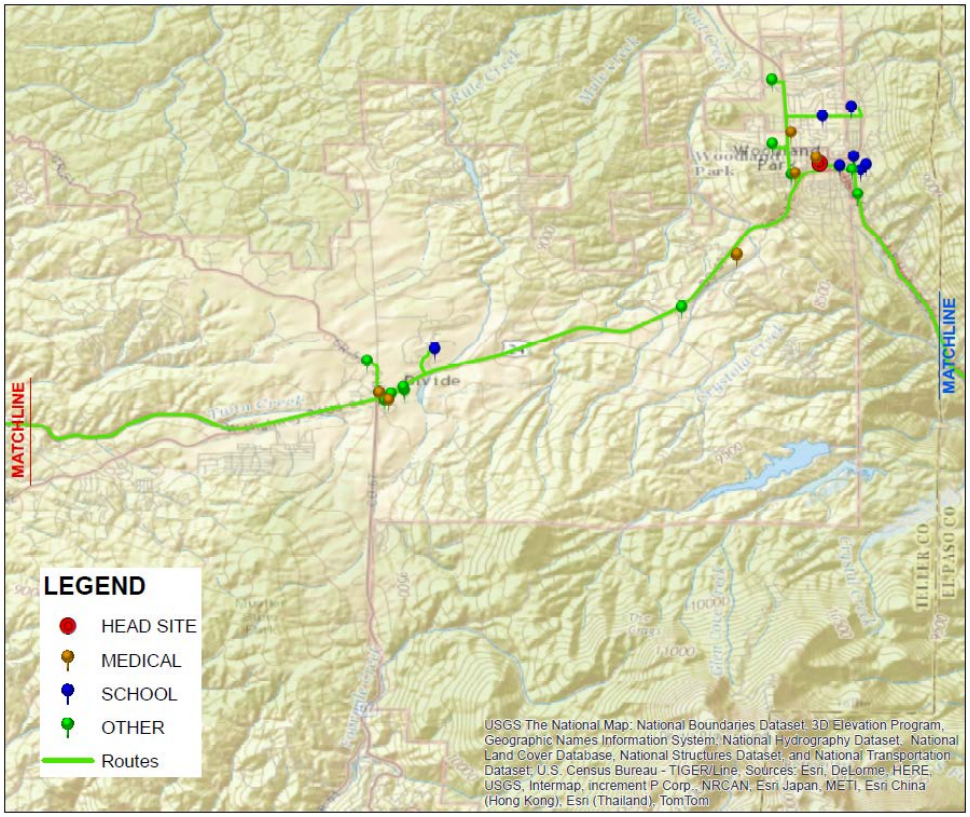
Estimate Dashboard – Western El Paso Co All Anchor Tenants

Estimate Dashboard				
Major Assumptions	**Values**			**Middle Mile**
# Parcels/Passings	0	Overall	Project Cost	$3,448,199
Middle Mile Connections	25		Cost per HHP	NA
# Poles	956		Cost per HHS	NA
Est. Aerial Miles	30.78		Cost per MI	$89,633.45
Est. UG Miles	7.69			
Aerial %	80%	Engr. Labor	Project Cost	$209,866
UG %	20%			
Density HH/Mile	-	Aerial Labor	Project Cost	$1,744,347
Take Rate	100%			
Make Ready Cost per mile (all in labor only)	$ 39,455.58	UG Labor	Project Cost	$711,345
ADSS or Strand/Lash	Strand/Lash			
Missile Bore/Open Trench %	0%	Tech Services Labor	Project Cost	$83,396
Directional Bore %	100%			
Plow %	0%	Customer Premise Labor and Install Materials including Splitters	Project Cost	$84,240
LD Downtown %	0%			
HD Downtown %	0%			
Rock Adder %	40%			
Cut/Restore %	2%	OSP Materials	Project Cost	$381,723
Make Ready Construction	yes			
OLT Equipment	yes	Electronics	Project Cost	$233,281

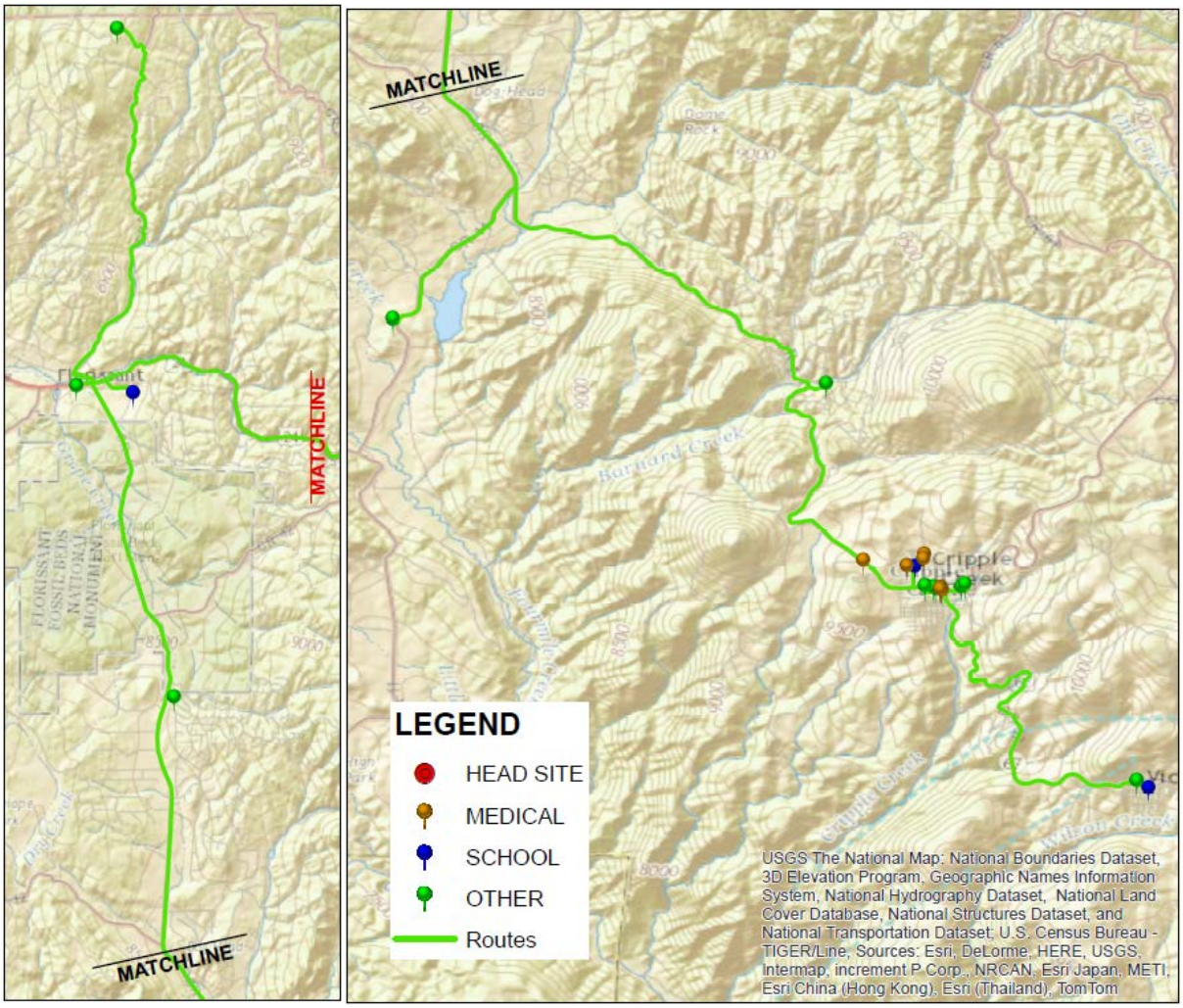


Below is more detailed maps of the proposed routes and anchor institutions for Teller County.

Teller Co Routing – All Anchor Tenants



Teller Co Routing – All Anchor Tenants – western detail



Targeting the Rural Healthcare Grant Program.

There are several locations in Colorado Springs that are included in this design. The reason for this is that these locations are medical facilities that are eligible for grant funding available through the Rural Healthcare Grant program.

The Rural Healthcare Grant fund is available for the following eligible entities:

(1) post-secondary educational institutions offering health care instruction, teaching hospitals, and medical schools;

(2) community health centers or health centers providing health care to migrants;

(3) local health departments or agencies;

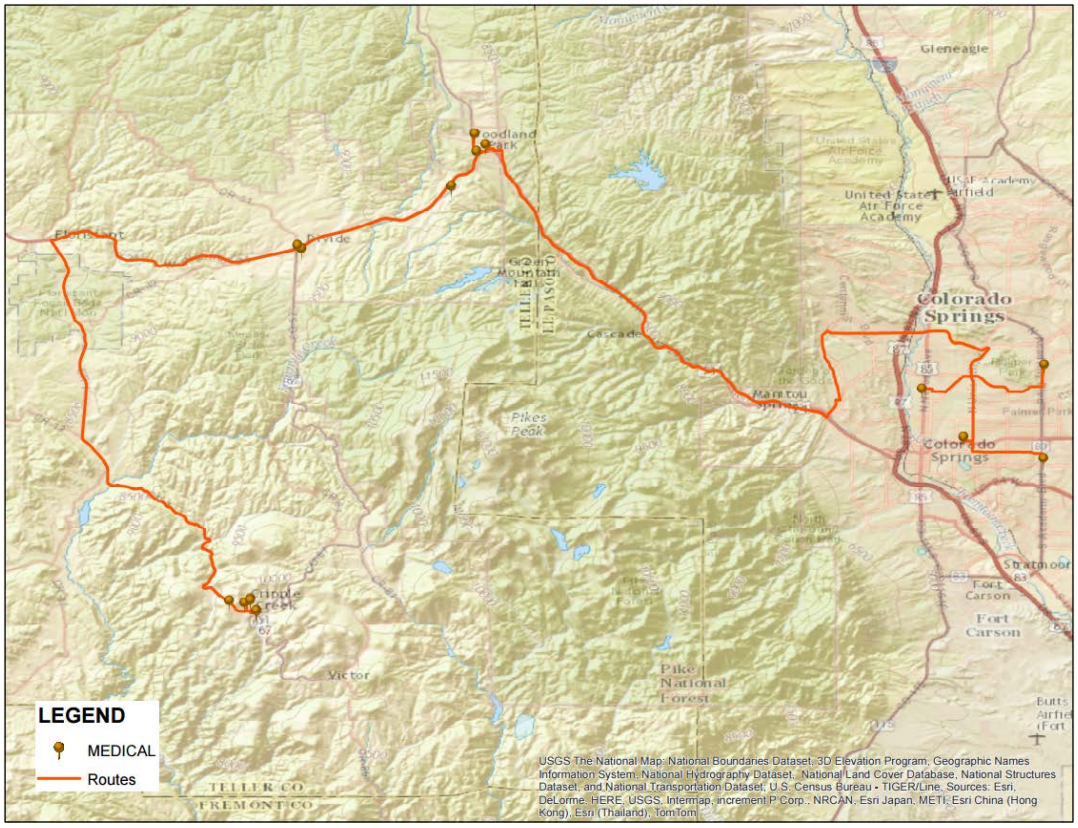
(4) community mental health centers;
(5) not-for-profit hospitals;
(6) rural health clinics; and
(7) consortia of one or more of such entities.

A list of the eligible locations with Teller and El Paso County has been vetted with the Colorado Telehealth Program and has been provided to members of the participating communities.

The grant program would potentially fund 65% of the capital costs to connect these medical establishments, including the middle mile portions of the fiber build between the communities. Targeting this grant, and building to the medical establishments "first" would allow for much of the desired routes to be built.

The following route would be contemplated for the Rural Healthcare Grant Program:

Medical Facilities

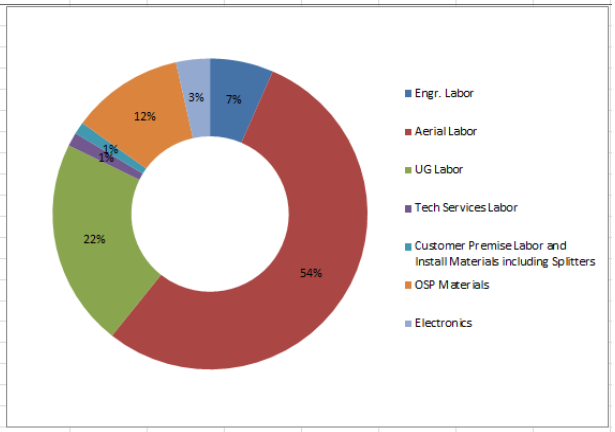


Estimate Dashboard – Teller and western El Paso County Medical Facilities

Estimate Dashboard

Major Assumptions	Values
# Parcels/Passings	0
Middle Mile Connections	22
# Poles	1755
Est. Aerial Miles	56.51
Est. UG Miles	14.13
Aerial %	80%
UG %	20%
Density HH/Mile	-
Take Rate	100%
Make Ready Cost per mile (all in labor only)	$ 39,455.58
ADSS or Strand/Lash	Strand/Lash
Missile Bore/Open Trench %	10%
Directional Bore %	90%
Plow %	0%
LD Downtown %	0%
HD Downtown %	0%
Rock Adder %	40%
Cut/Restore %	2%
Make Ready Construction	yes
OLT Equipment	yes

		Middle Mile
Overall	Project Cost	$5,907,027
	Cost per HHP	NA
	Cost per HHS	NA
	Cost per MI	$83,621.56
Engr. Labor	Project Cost	$385,364
Aerial Labor	Project Cost	$3,200,123
UG Labor	Project Cost	$1,274,312
Tech Services Labor	Project Cost	$84,142
Customer Premise Labor and Install Materials including Splitters	Project Cost	$74,131
OSP Materials	Project Cost	$683,206
Electronics	Project Cost	$205,749



The incremental routes to add on the rest of the anchor institutions would then be shown in green on the revised maps.

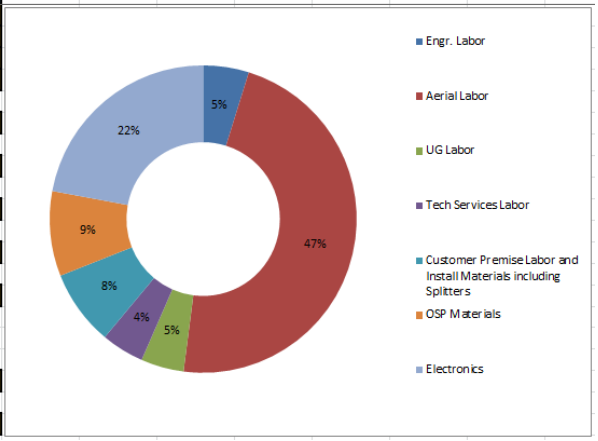
Medical Facilities with All Anchors Added

All of the anchor institutions in western El Paso County are close to the proposed route. The incremental costs of adding on the remaining anchor institutions for western El Paso County are:

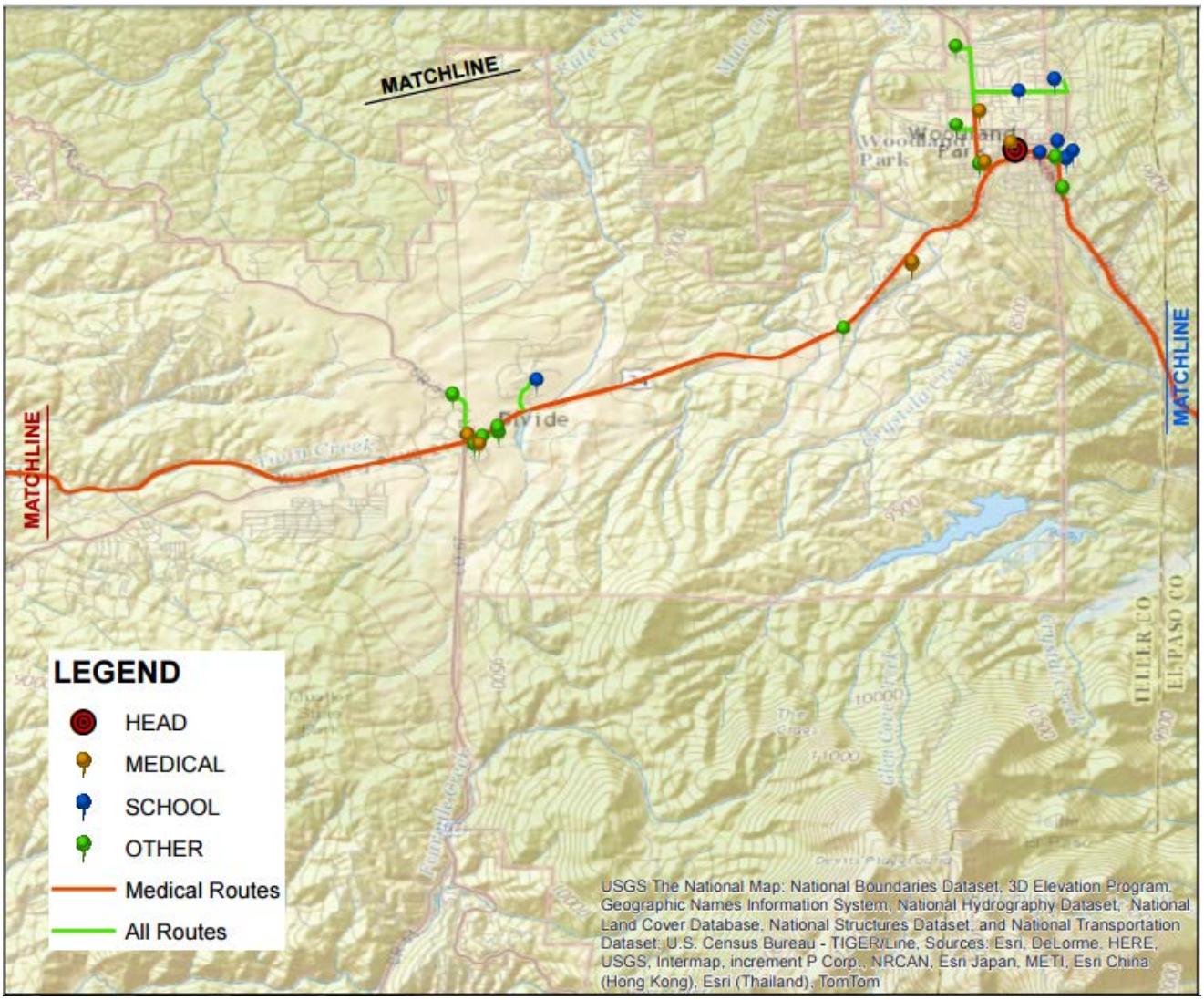
Estimate Dashboard

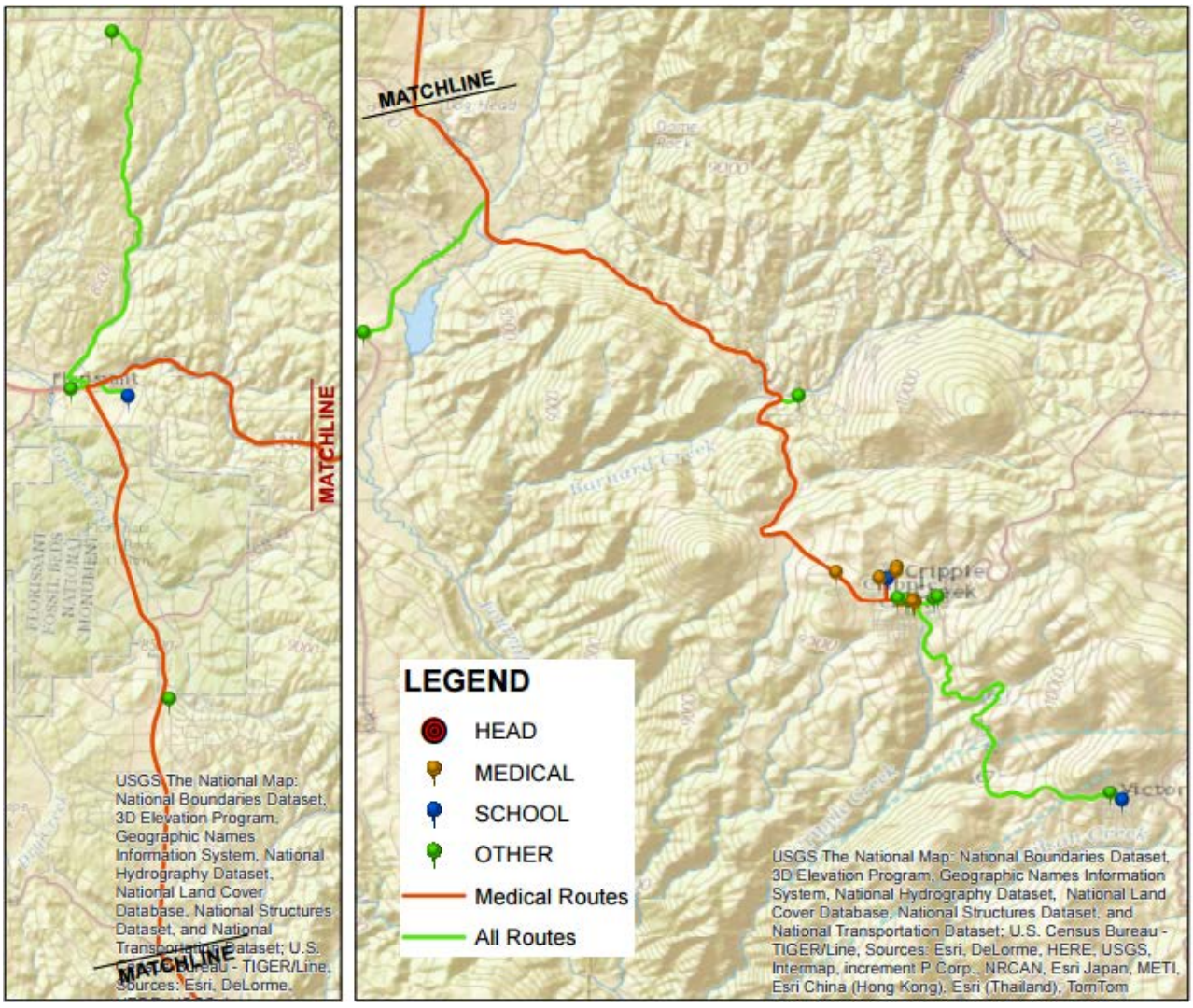
Major Assumptions	Values
# Parcels/Passings	0
Middle Mile Connections	20
# Poles	219
Est. Aerial Miles	7.05
Est. UG Miles	0.37
Aerial %	95%
UG %	5%
Density HH/Mile	-
Take Rate	100%
Make Ready Cost per mile (all in labor only)	$ 39,455.58
ADSS or Strand/Lash	Strand/Lash
Missile Bore/Open Trench %	0%
Directional Bore %	100%
Plow %	0%
LD Downtown %	0%
HD Downtown %	0%
Rock Adder %	40%
Cut/Restore %	2%
Make Ready Construction	yes
OLT Equipment	yes

		Middle Mile
Overall	Project Cost	$848,971
	Cost per HHP	NA
	Cost per HHS	NA
	Cost per MI	$114,416.64
Engr. Labor	Project Cost	$40,837
Aerial Labor	Project Cost	$400,993
UG Labor	Project Cost	$38,422
Tech Services Labor	Project Cost	$38,189
Customer Premise Labor and Install Materials including Splitters	Project Cost	$67,392
OSP Materials	Project Cost	$75,744
Electronics	Project Cost	$187,394



The incremental and add-on routes for Teller County are shown below in green.


MATCHLINE
MATCHLINE
MATCHLINE
Divide
Woodland Park
TELLER CO
EL PASO CO
LEGEND
HEAD
MEDICAL
SCHOOL
OTHER
Medical Routes
All Routes
USGS The National Map: National Boundaries Dataset, 3D Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; Sources: Esri, DeLorme, HERE, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom



This is one of the ways the capital costs could be paid through leveraging grant programs and potential collaboration:

Possible Allocation of Grant Funding and Contributions	Total Capital Costs	Rural Healthcare Grant	CDOT
Medical Facilities	$ 5,907,027	$ 3,839,568	$ 2,067,459
	Total Capital Costs	**DOLA**	**Other Partners, Communities, Colorado Springs Utilities**
Adding on the Other western El Paso County Anchor Institutions	$ 848,971	$ 424,486	$ 424,486
Adding on the Other Teller County Anchor Institutions	$ 2,501,962	$ 1,250,981	$ 1,250,981
Subtotal	$ 3,350,933	$ 1,675,467	$ 1,675,467
Total Capital Costs	**$ 9,257,960**		

This is by no means the only way capital costs could be shared; however, it is perhaps a good place to start for negotiating with various partner entities. The point here is that in leveraging grant programs available and by collaborating and sharing in the remaining capital costs, the overall cost for all partners would be substantially lower.

Expansion to Existing Tower Facilities

Another strategy for improving broadband service within the Counties is to install fiber to key tower facilities. These costs may be shared between the various service providers, cellular companies and wireless providers. Bringing fiber to the tower could boost available bandwidth to the end users. In NEO's companion report to follow, recommendations regarding potential tower locations, policies and capital costs considerations will be addressed.

Grant Programs and Financing Options

Municipalities and counties may finance these broadband networks through obtaining revenue bonds or general obligation bonds. This financing is typically available for low interest rates of 3-6%. Alternatively, financing for a private sector fiber network may have interest rates of 5-15%.

There are grant and loan programs that are also available for broadband build-out. Certain financing and funding programs restrict who is eligible to apply for and receive funding. The federal grant and loan programs available for funding broadband construction include the following:

	State-Level	Federal Level				
Grants	**DOLA**	**Rural Broadband Experiments, Connect America**	**Community Connect Grants**	**Distance Learning and Telemedicine Grant Program**	**Health Connect, Rural Healthcare Program**	**E-rate**
Eligibility						
Regional Council of Governments	Yes	-	-	-	-	-
Local Government, Tribes	Yes	Yes	Yes	Yes	-	-
Non-profit	-	Yes	Yes	Yes	-	-
Corporations	-	Yes	Yes	Yes	-	-
Cooperatives	-	Yes	Yes	Yes	-	-
Education	-	-	-	Yes	-	Yes
Medical Providers	-	-	-	Yes	Yes	-
Eligible Telecommunications Carrier	-	Required	-	-	-	-
Timing	Ongoing	FY2015 Application window closed, due dates typically in January, February 2016	Grant cycle is in early part of year.			
How much?	$20 Million for 2015, April, August and December 1 deadlines	$100M total, grant amounts dependent upon technology/bandwidth		Grants available for Equipment, inside wiring and "other facilities"		
Other	50% Match, 1/2 of which may be in-kind	Rural areas that lack any existing broadband speed of at least 3 Mbps (download plus upload) are eligible.				

The Colorado Department of Local Affairs (DOLA) in 2015 announced a $20 Million broadband implementation grant program for regional councils of governments and municipalities. In 2015, DOLA had three rounds of financing applications with deadlines for grant submission being April 1st, August 1st and December 1st. DOLA has not yet announced funding availability for 2016 specifically for broadband implementation; however, applicants are encouraged to apply for funding through the Energy and Mineral Impact Fund.

The Rural Broadband Experiments and Connect America programs are available to unserved areas; the definition for eligibility is 3 Mbps combined upload and download. As the FCC in 2015 raised the definition of served to 25 Mbps download and 3 Mbps in upload speeds, there may be funds available through the Connect America to a wider group of communities. One caveat currently of the Connect America program is that it is available for Eligible Telecommunication Carriers.

The Telecommunications Infrastructure Loan Program available through the USDA "makes long-term direct and guaranteed loans to qualified organizations for the purpose of financing the improvement, expansion, construction, acquisition, and operation of telephone lines, facilities, or systems to furnish and improve Telecommunications service in rural areas. The definition for "rural area" is within the boundaries of any incorporated or unincorporated city, village, or borough having a population less than 5,000 inhabitants."

The Rural Broadband Loan Program, which is part of the Farm Bill, "is designed to provide loans for funding, on a technology neutral basis, for the costs of construction, improvement, and acquisition of facilities and equipment to provide broadband service to eligible rural communities." Again, the definition of rural includes communities with a population less than 5,000 inhabitants.

Other sources of funding should also be considered. These include internal loans, bonds, TIF and revenue funds, economic development financing programs, and crowd sourcing.

E-rate is available for schools and in the past was used to as a reimbursement or supplement for Internet access services. The E-rate program has had a number of changes recently; one significant change is the ability to reimburse for construction of facilities (i.e. fiber optic cable) to serve the school.

There are grant programs that are available for Telemedicine and Distance Learning as well as program targeted specifically for Rural Health.

There are a number of other financing options some of which include; New Market tax credits, for which allocations would have to be secured; economic development retail sales tax funds, and bond financing through a number of different structures and types of bonds. A report written by NTIA referencing all federal programs available for broadband financing has been provided to Teller and El Paso Counties as a deliverable of this project.

Tabor Laws

Financing of a broadband network, just like the financing of any other public project, is governed by state law, and primarily by the Constitutional Amendment known as the Taxpayer's Bill of Rights (TABOR). Colorado Constitution, Article X, Section 20. With respect to incurring debt, Section 20 (4)(b) of TABOR requires an election prior to "creation of any multiple-fiscal year direct or indirect district debt or other financial obligation whatsoever without adequate present cash reserves pledged irrevocably and held for payments in all future fiscal years." To the extent that the financing of a broadband network, or any components of a network would require the issuance of debt, the various municipalities and the County would be required by TABOR to seek a vote of the registered electors. To the extent that the municipalities or the County owns or controls existing network facilities that it wishes to use in a network, or has the financial resources to pay for new facilities, it may do so without an election.

Statutory municipalities are granted their authority in Title 31 of the Colorado Revised Statutes. Among the powers of statutory municipalities are the power to enter into contracts and the power to acquire, hold, lease, and dispose of both real and personal property. C.R.S. 31-15-1(b) and (c). The municipality also has the power to contract indebtedness (subject to TABOR) by borrowing money or issuing the bonds of the municipality "for *any public purpose* of the municipality, including *but not limited to* the following purposes: Supplying water, gas, heating and cooling, and electricity; purchasing land; and purchasing, constructing, extending, and improving public streets, buildings, facilities, and equipment…" C.R.S. 31-15-302(1)(d)(I). While this section of the statute does not specify telecommunications, the authority granted to the municipality is specifically not limited to the examples stated, and the broadband facilities the municipality considered would, according to Denver-based attorney, Ken Fellman, be deemed a public purpose, and therefore permitted. That being said, the total amount of the municipality indebtedness for all authorized purposes may not exceed three percent of the actual value, as determined by the assessor, of the taxable property in the municipality. C.R.S. 31-15-302(1)(d)(II).

Section 7 – Establish a Non-profit Entity

As mentioned earlier in the report, the Local Technology Planning Team (LTPT) would not be able to apply for grant funding and own infrastructure. The two counties may not be the best candidates to pursue funding either. The members representing the various entities that make up the LTPT may have differing goals and objectives. For example, in meeting with Teller County Commissioners, the commissioners differed on their opinion of how government should be involved in solving broadband challenges. Additionally, the healthcare facilities and hospitals are key players in seeking grant funding. They too should be involved in this endeavor. Most likely a new entity should be set up to pursue grant funding, build some infrastructure and manage the allocation of fiber infrastructure amongst the various members of the non-profit organization.

Section 8 – Addressing Sustainability, Maintenance and Operations of the Network

The network could be maintained by outsourcing maintenance activities to a third party. Other non-profit organizations operating in this manner have a revenue share/maintenance contract in place with service providers who provide Internet services to the end users. An appropriate revenue share is more heavily weighted to the infrastructure owner, as the infrastructure owner paid for the capital costs of the network and owns the network. In this case, the infrastructure owner may be a new not for profit organization.

Sharing in the capital costs may be the only desired way to monetize the network. The costs could be divided amongst the various partner entities and/or through long term Indefeasible Right of Use (IRUs).

Section 9 - Benefits of Advanced Broadband Networks and Why This Matters, Abundant Broadband is a Necessity for Economic Vitality

The following section is taken from a white paper written by NEO Connect. The information is relative to this project in understanding the applications and trends in broadband services. This section discusses the community benefits of advanced broadband networks and provides the context of why building Gigabit-enabled networks are important.

Stimulate Economic Growth. **Many municipalities across the country are deploying next-generation, high-bandwidth telecommunications networks as a means of stimulating economic growth and development.**

Our world is changing; and it is doing so rapidly. Technology is impacting every part and parcel of our lives -- from where and how we conduct work, to whether or not we thrive economically and socially. It has impacted the way we live, our entertainment, our culture, the way government services are provided and accessed, the way healthcare is being delivered, and the way we educate our children and provide education to better improve our workforce. With the introduction and accelerated advancement of technologies, having access to affordable, redundant and abundant broadband is quickly becoming the most critical infrastructure of our time, just like electricity and transportation were in the early 1900's. Advanced broadband infrastructure has the potential to create more jobs, increase the community's competitive ability globally, create new technologies, increase opportunities for the region's companies, enhance public safety, provide better and less expensive healthcare, and provide greater educational

opportunities throughout our community. In a recent meeting/webinar and report produced by Brookings in May of this year, fiber was added as a critical infrastructure.[4]

Advanced broadband networks are creating seismic changes in local, state, national and global societies, as well as markets, business and in institutions around the world. Access to social media and the Internet has shifted governments, threatened national and local boundaries, inspired revolutions, and has changed us culturally. The Internet and its associated technologies have impacted wealth, work, education, government, health, public safety, and education. Having equal access to advanced broadband networks bridges the digital divide and creates better equality between the haves and the have-nots.

Like the introduction of electricity, advanced broadband networks are fundamentally changing our world in ways that were not expected or anticipated. Much like electricity, advanced broadband networks are the enabling technology in which all things are impacted. Electricity was invented to turn on the lights, but empowered – literally, the transformation to an industrial society. Advanced broadband networks are now the enabling technology to transform us yet again, to a global technology and information society; the new Knowledge Economy. (See *Captive Audience* by Susan Crawford).

Just as it was impossible to know in advance the impact that electrification would provide the critical infrastructure to power all of our modern appliances, computers, health monitoring systems, manufacturing facilities, computers, radio and television, and financial markets; so too, is it impossible to predict the impact and reach of advanced broadband networks. We do not yet know the far reaching impacts that the Internet will have on our lives and on generations to come. However, it is certain that NOT having access to advanced broadband networks would be equivalent to being in the dark without electricity!

The incumbent providers of phone service, Internet and cable TV services are not building best-in-class broadband networks fast enough. The model by which these services are being provided needs to shift dramatically to enable faster deployment of advanced services, affordable

[4] Joseph Kane and Robert Puentes, "Beyond Shovel Ready: The Extent and Impact of U.S. Infrastructure Jobs," Brookings Institution, (May, 2014) available at http://www.brookings.edu/research/interactives/2014/infrastructure-jobs#/M10420

broadband and abundant capacity to support our current and future needs for bandwidth.

Speed Matters. **Global network traffic has quadrupled from 2009 to 2014. Both commercial and residential Internet bandwidth consumption are doubling every year.**

Bandwidth refers to the capacity, or speed of the networks to carry traffic. The question is often presented, "How fast is fast enough?" and "What should be the definition of broadband?" The Federal Communications Commission (FCC) has proposed in the National Broadband Plan that broadband be defined as 50 Mbps "downstream" (to the consumer) and 20 Mbps "upstream" (from the consumer into the network) by 2015.[5] Given the growth trends in bandwidth needs and network traffic, this definition is conservative and barely meets the minimum needs for bandwidth consumption today and certainly does not address the needs that are forthcoming.

In the early days of the Internet, text messaging, email and web sites were not data-rich or bandwidth intensive and the average consumer did not need more than 7 Mbps of bandwidth. When YouTube burst upon the scene in 2005, this dramatically changed things. One video download was the equivalent of downloading 30,000 web pages. Since that time, videos and picture-rich content have been downloaded and uploaded on a regular basis by the masses. The applications we use on the Internet are becoming much more feature-rich and bandwidth intensive and our existing networks cannot keep up with the demand for networks that support these applications.

The Fiber to the Home Council (FTTH) stated its position clearly in a brief to the FCC. "Even today, with most users still operating on last-generation broadband technologies, the capabilities of advanced video, cloud-based services, and other bandwidth-intensive applications are growing at a pace beyond what our existing networks are capable. Cisco and other scientific companies talk about the network in terms of "terabytes" of capacity in the network center, or

[5] Federal Communications Commission, *Connecting America: The National Broadband Plan* (Mar. 17, 2010). Available at http://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf

"core."[6] According to the Cisco 2012 Zettabyte Report, businesses today routinely require symmetrical gigabit service between their locations."[7]

Also referenced in the Cisco 2012 Zettabyte Report, global Internet traffic grew 45 percent during 2009 alone and has doubled every year since then. Both commercial and residential Internet bandwidth consumption are doubling every year, as video, cloud computing, advanced storage solutions, telemedicine, telecommuting, video conferencing, etc., are becoming more prevalent from end users. Applications are becoming more bandwidth intensive and as more devices – tablets, Smartphones, computers, appliances – are being used both in the home and for business applications. ***Research conducted by Cisco states by 2016, there will be nearly three Internet Protocol or IP-connected devices per person.*** Internet-connected televisions, radios, set-top boxes, Blu-ray players, Netflix, cameras and picture frames now receive or deliver movies, TV and photos through the Internet.

According to FTTH's brief to the FCC referenced above, "the average monthly traffic in 2014 on the Internet has been equivalent to 32 million people streaming Avatar in 3D, continuously for the entire month." In 2014, video downloads and uploads comprised 50 percent of all Internet traffic. In the coming years, the sum of all forms of Internet Protocol (IP) video (Internet video, video on demand, video files exchanged through file sharing, video-streamed gaming, and videoconferencing) will reach 86 percent of the total Internet traffic. Applications supported by cloud-based services through multiple devices have created the need for always-on connectivity and advanced broadband network bandwidth.

[6] Fiber to the Home Council, "America's Petition to the Federal Communications Commission for Rulemaking to Establish a Gigabit Communities Race-to-the-Top Program," July 23, 2013.
[7] Cisco, "*The Zettabyte Era*" (May 30, 2012).

Application	Rate
Personal communications	300 to 9,600 bits/sec or higher
E-mail transmissions	2,400 to 9,600 bits/sec or higher
Remote control programs	9,600 bits/sec to 56 Kbits/sec
Digitized voice phone call	64,000 bits/sec
Database text query	Up to 1 Mbit/sec
Digital audio	1 to 2 Mbits/sec
Access images	1 to 8 Mbits/sec
Compressed video	2 to 10 Mbits/sec
Medical transmissions	Up to 50 Mbits/sec
Document imaging	10 to 100 Mbits/sec
Scientific imaging	Up to 1 Gbit/sec
Full-motion video	1 to 2 Gbits/sec

Service	Bandwidth	Number of Devices	Bandwidth Home Area Network	Bandwidth Residential Gateway to Network
TV	2 to 20 Mbps	3.5	2 to 70 Mbps	2 to 70 Mbps
DVR	2 to 20 Mbps	2	2 to 40 Mbps	0
Home Theater	1 to 6 Mbps	1	1 to 6 Mbps	0
Internet Browsing	1 to 20 Mbps	1 to 5	1 to 100 Mbps	1 to 10 MBPS
Printer	.5 to 1 Mbps	1 to 5	.5 to 5 Mbps	0
Digital imaging	1 to 20 Mbps	1 to 3	1 to 60 Mbps	0
On-line Gaming	.2 to 1 Mbps	1 to 3	.2 to 3 Mbps	.2 to 1 Mbps
Video Capture	.1 to 1 Mbps	1 to 10	.1 to 10 Mbps	.2 to 3 Mbps
Portable Audio	.1 to 20 Mbps	1 to 3	.1 to 60 Mbps	0
Total	**70 to 100 Mbps**		**12.5 to 354 Mbps +**	**4 to 84 Mbps +**

Table 1, Applications and their Needed Bandwidth

While Internet bandwidth use is doubling, cellular networks are also greatly overextended.

In addition to explosive growth in Internet consumption from homes and businesses, mobile Internet use has also advanced dramatically. Smartphone applications are spurring higher consumption of multimedia services. With tablet computers and smartphones having easy access to games, e-books, TV programs, email, shopping, banking and social media sites, wireless service providers have been scrambling to upgrade their networks.

The need for advanced broadband connectivity must include both a consideration for fiber, connecting our businesses, offices and establishments, homes; as well as wireless and cellular, allowing for mobile and portable access as we travel, move about and commute.

Community Outreach and Support. **All-Fiber networks are imperative, critical and necessary to stimulate economic development and growth.**

Municipalities, communities and regions that want to impact economic development must build 21st Century infrastructure.

Municipalities, communities and regions that have deployed all-fiber networks have already seen the tremendous economic impact of building symmetrical gigabit networks. These communities have fostered an environment of innovation, economic development and growth, collaboration, and creative activities. ***According to a 2012 survey of economic development professionals, 60 percent said that 1 Gigabit of service had a "definite impact" on new businesses that moved to an area.*** As having access to advanced broadband services is the number one priority for large businesses as they are looking for commercial real estate, the communities that have built gigabit-enabled fiber networks have already benefited economically by attracting businesses and industries to re-locate to their communities.

After Chattanooga deployed their Gigabit network, the city attracted numerous high-tech firms, and entrepreneurs to relocate their company facilities, including Amazon, Alstom, and Volkswagen amongst others. Several venture capital firms were established in Chattanooga after their Fiber to the Home network was built because this fostered a business climate that was perfect for innovation and creativity. When surveyed, 42 percent of economic development professionals claimed that 1 Gigabit of service actually attracts new businesses to an area (see Table 3). Since building its gigabit network, Chattanooga has created over 7,000 new jobs and attracted billions of dollars in capital investment in a city once referred to as the "dirtiest city in America."[8]

In 2012, the Chattanooga Electric Power Board (EPB) established Gig Tank, an application-incubation facility. The goal of Gig Tank is to build applications to utilize the capabilities of gigabit networks. According to its website, "Gig Tank is a startup accelerator connected to a living, metro-wide fiber optic network. Hosted by the Company Lab, this annual program attracts entrepreneurs from across the globe to Chattanooga, the home of America's first widely-available gigabit Internet service. With Internet speeds that run 100x faster than the national average, Chattanooga offers entrepreneurs the opportunity to innovate on the broadband platform of the future." This year, Gig Tank is focusing on three start-up tracks accelerating seed stage startups in the additive manufacturing (3D printing), smart grid and healthcare industries by connecting these new companies with the tools, capital and connections to go to market.

[8] Chattanooga's "Gig Tank" website, available at http://www.thegigcity.com/gigtank/

Chattanooga itself has experienced great success with its smart grid system that is running on the city's all-fiber network. The smart-grid system promotes energy efficiency throughout the city, remotely monitoring the system's power consumption, load balancing and power substations. It allows the electric system to re-route around failures and downed power lines in storms and outages, restoring services within minutes. Prior to the smart-grid system implementation, typical outages may have lasted four to five hours and many neighborhoods may not have had services restored until residents notified Chattanooga's EPB of the outage. Today, with the new smart-grid system in place over the all-fiber network, EPB can restore service in minutes. Savings realized by better management of the city's power system and improved operations has paid for the cost of deploying the Fiber to the entire community system.[9]

Similar to Chattanooga's Gig Tank program, entrepreneurs have developed gigabit-ready applications through the US Ignite Partnership.[10] US Ignite is a non-profit, public-private organization that is supported by the White House Office of Science and Technology and the National Science Foundation. US Ignite is focusing on creating applications in the following disciplines of national priority:

- Education and Workforce
- Energy
- Health
- Public Safety
- Transportation
- Advanced Manufacturing

In addition to creating transformative applications, US Ignite connects people and resources, coordinates test beds, provides efforts towards scalability and providing these applications to the masses, informs the public and takes these applications to market. One cutting-edge application being developed by researchers at the University of Massachusetts, and supported by US Ignite, is the Collaborative Adaptive Sensing of the Atmosphere ("CASA") program. CASA uses predictive storm-tracking technology and "data 5 to 10 times more detailed than current radar systems" to provide citizens with advanced notification of severe weather events. These

[9] Mike Smalley, "Broadband and the Smart Grid," (2008) available at http://www.carinatek.com/PDFs/BBP_AugSep08_SmartGrid.pdf

[10] US Ignite, available at https://us-ignite.org/about/what-is-us-ignite/

applications, as well as all of the other applications developed by US Ignite, are only possible with having access to a minimum of 100 Mbps of bandwidth. US Ignite is participating with municipalities and communities that have built out fiber networks and are offering this type of bandwidth to their constituents.

Kansas City offers another example. When Google issued a Request for Proposal for the "Think Big with a Gig" program to host gigabit test-beds and have Google build within their city, over one thousand communities across the country submitted applications.[11] Google selected the bi-state Kansas City metropolitan region. Kansas City has already seen an uptake in new high-tech start-ups due mostly to Google's FTTH efforts. Through Homes for Hackers and the Kansas City Startup Village, entrepreneurs have built a community of innovators enticed by the possibilities presented by the Google Fiber network.[12] A prominent venture capitalist has even purchased a home in a Kansas City "fiberhood" to allow entrepreneurs to live for free in Kansas City and build gigabit-ready applications. High-tech companies recognize the benefits of these networks and are willing to relocate just to have access to them.

Since Google's roll-out of gigabit services in Kansas City, it has made plans to build Fiber to the Home in Austin and has recently purchased an existing system in Provo, Utah. Google last year announced plans to build FTTH in 34 municipalities across the country upon cooperation and attainment of a checklist put out by Google.

Other communities that have built fiber networks have shown economic growth by attracting manufacturing, high-tech and technology companies in large part because of their investment in all-fiber networks.

Telecommuting Opportunities

The number of people working from home or telecommuting has increased enormously in the past few years and will increase exponentially in the future. According to a study conducted by the Global Workplace Analytics[13], telework grew nearly 80% from 2005 to 2012. In 2010, based on its own limited survey, *WorldatWork* estimated that 16 million employees worked at home at

[11] Topeka, Kansas, even changed their name to Google in hopes of being selected as the test-bed.
[12] Kansas City Startup Village, available at http://www.kcstartupvillage.org; and Homes for Hackers, available at http://homesforhackers.com.
[13] Global Workplace Analytics Recent Statistics on Telecommuting available at http://www.globalworkplaceanalytics.com/telecommuting-statistics

least one day a month, a number that increased almost 62% between 2005 and 2010. Extrapolating from 2010 to 2014 would put the current number of those who telecommute at least one day a month at approximately 25 million.

According to the study, in twenty-five percent of the nation's 20 largest metro areas, more people now telecommute than use public transportation as their principal means of transportation to work. More importantly, according to Global Workplace Analytics, the estimated based upon the current labor force composition is that 64 million U.S. employees hold a job that is compatible with at least part-time telework (50% of the total workforce). 79% of U.S. workers say they would like to work from home at least part of the time (WorldatWork Telework Trendlines 2009) and 87% of federal employees say they want to work from home (2013 Federal Viewpoint Survey).

There are significant economic benefits from telecommuting and working from home. According to the Global Workplace Analytics website, "If those with compatible jobs and a desire to work from home did so just half the time (roughly the national average for those who do so regularly) the national savings would total over $700 Billion a year." Other data points from the website are:

- A typical business would save $11,000 per person per year
- The telecommuters would save between $2,000 and $7,000 a year
- The oil savings would equate to over 37% of our Persian Gulf imports
- The greenhouse gas reduction would be the equivalent of taking the entire New York State workforce permanently off the road.
- The Congressional Budget Office's estimate of the entire five-year cost of implementing telework throughout government ($30 million) is less than a third of the cost of lost productivity from a single day shut-down of federal offices in Washington DC due to snow ($100 million).

According to the Aspen Institute's Communications and Society Program's recent publication, "The Future of Work", (2011) work is no longer confined to a specific time and place. Open systems, open platforms, shared folders and databases, "crowdsourcing," and collaboration between employees, contractors, vendors and suppliers happens "in the cloud" facilitating the ability to work anywhere there is a high-speed Internet connection, at any time.[14]

[14] David Bollier, *"The Future of Work, What it Means for Individuals, Markets, and Governments,"* Aspen Institute's Communications and Society Publication, (2011).

Providing the ability for people to work from home or from Internet meeting rooms – i.e. the local coffee shops, libraries, community centers, co-working spaces, incubator locations or virtual offices -- requires access to advanced broadband services. The benefits and cost savings of telecommuting can only be realized when workers have access to abundant broadband. If work is portable, people will choose communities that are rich in culture, art, entertainment, recreation, educational opportunities for kids and adults and are affordable. Work is no longer tied to place. Communities need to change to attract and maintain this new *portable* workforce.

Every "Thing" will be Connected to the Internet: Medical Devices, Health Monitoring Systems, Our Cars, Our Clothes, Household Systems, Appliances, Energy Controls – the "Internet of Things."

Every good thing out there is connected to the Internet; the new "Internet of Things." These things include household systems that monitor security systems, locks, energy use, temperature, and water control. It includes appliances that call automatically for maintenance; make shopping lists, schedule events, order parts, and schedule repair -- all without the need for human intervention or oversight.

The Internet of Things includes medical devices that monitor our health, detect and alarm us when medical issues are present, clothes that detect glucose levels or heart conditions, and hats that monitor our brain activity. Cars are now connected to the Internet, monitoring the car's status and performance, notifying drivers of traffic delays, alternative routes, hazardous conditions and mechanical issues. Soon cars will drive themselves. Internet-connected cars will provide anti-collision technology, automatically braking and steering clear of accidents or potential accidents. Our coming and going, our location, customer information and applications will all be collected, stored and monitored. Some of this sounds a bit uncomfortable; however, the reality of all of this is here. Devices are all Internet-enabled. Although we as individuals will need to determine how far and how much data we want to have shared and collected, it is clear that the Internet of Things is only enabled with advanced broadband capacity.

Affordable Healthcare: The growing Baby Boomer population and the implementation of the Patient Protection & Affordable Care Act will create new challenges for our healthcare system.

The baby boomers are getting older; the largest portion of our population is aging. Concerns of increased healthcare costs with our aging society will need to be curbed by providing better, smarter, more cost-effective healthcare. Implementation of the Patient Protection and Affordable Care Act is placing new demands on the medical industry to become more efficient, cost effective and nimble, demanding that physicians interact with more patients.

Telemedicine is the use of information technology including the telephone, the Internet and personal computers, for diagnosing, treating and monitoring patients. Telemedicine is adding a new dimension to modern health care. These advances are not only making care more accessible and convenient, they are lowering the costs of medical care, while not sacrificing the quality of care, and in many studies, improving the quality of care. Physicians can consult with more patients, and patients can meet with their physicians in a shorter time period. Less time is spent checking the patient in and leading the patient to the exam room. In terms of economic advantages, telemedicine can save a great deal of time for patients who otherwise would have to leave work. Telemedicine can also eliminate many ER visits, which are often the costliest means of providing healthcare services.

According to the Wellness Councils of America (WELCOA), as many as 70 percent of primary care visits, and 40 percent of emergency room visits to treat acute medical conditions could have been diagnosed and prescribed medication all over the phone.[15] The methodology of providing care has not changed; however, the medium for providing care has. The physician can perform diagnostic testing, interview the patient, check vital signs, etc. remotely using videoconferencing and remote monitoring equipment, and the telephone or internet; instead of providing these services in person.

[15] Wellness Council of America, "Collecting Data to Drive Health Efforts," available at https://www.welcoa.org/resources/collecting-data-drive-health-efforts-classic-edition/

The American Telemedicine Association highlights various reports on the efficacy, cost savings, improved healthcare and patient benefits of telemedicine.[16] One report highlights the experience of UPMC Health Plan, an integrated delivery and financing system headquartered in Pittsburgh, Pennsylvania, in its efforts to support primary care practices as they converted to patient-centered medical homes. From 2008 through 2010, sites participating in the UPMC pilot achieved lower medical and pharmacy costs; more efficient service delivery, such as lower hospital admissions and readmissions and less use of hospital emergency departments; and a 160 percent return on the plan's investment when compared with nonparticipating sites.

Presbyterian Healthcare Services based in Albuquerque, New Mexico, adapted the Hospital at Home® model developed by the Johns Hopkins University Schools of Medicine and Public Health to provide acute hospital–level care within patients' homes. In this program, patients show comparable or better clinical outcomes compared with similar inpatients, and they show higher satisfaction levels. Available to Medicare Advantage and Medicaid patients with common acute care diagnoses, this program achieved savings of 19 percent over costs for similar inpatients. These savings were predominantly derived from lower average length-of-stay and use of fewer lab and diagnostic tests compared with similar patients in hospital acute care.

Additionally, patients that are participating in a home health program or telemedicine program experience higher satisfaction as they receive more personal one-on-one care, without taking time from work to travel to a medical clinic and wait for their appointment with the doctor. The source of satisfaction for most patients is the ability to see a specialist trained in the area most closely related to the patient's condition, the feeling of getting personalized care from a provider who has the patient's interest in mind, and the ability to communicate with the provider in a very personal and intimate manner over the telecommunications technologies.

With the Internet of Things for Medical Devices, it is now possible to remotely monitor a patient's health with the use sensors, detectors, actuators and the Internet. Medical remote monitoring devices are connected to the Internet where a patient's vital statistics get transmitted via a gateway onto secure cloud-based platforms where the data is collected, stored, monitored and analyzed. These devices can monitor and alert physicians or loved ones if a patient's vitals fall outside a healthy range. Scanners can monitor inventory levels for pharmaceuticals before a

[16] American Telemedicine Association, numerous case studies available at http://www.americantelemed.org/about-telemedicine/telemedicine-case-studies

medication runs out and order supplies and inventory ensuring that hospitals and clinics have the needed supplies.

Other medical applications enabled with advanced broadband include medical training and consultation with other physicians and providers, electronic health records, and the ability to log-in and read patient charts, MRIs and X-rays.

Education and Distance Learning: **Our workforce must continue to evolve through workforce training and education. The manner in which we provide education to our kids and to adults is changing, requiring us to access information and education through distance learning and reverse classroom experiences.**

The concept of working for a single company or within a single industry for thirty years until retirement is no longer an economic reality. Workers will change careers an average of seven times during their lifetime. Workers cannot expect to enjoy a "steady job" with a lifelong employer, nor expect that employer to provide the training and skills needed as the work changes. Workers will require on-going training, education and mentorship. Many of these resources for further education and mentoring are now mostly available on-line and virtual. Educational institutions, workforce training, universities, and corporations must provide education when people can use it, rather than at a specific place and time, working around lifestyle, schedules and work/home priorities and pressures.

Homework assignments, testing and accessing educational videos are all on-line. The methodology by which education is happening is changing. Schools are providing the reverse classroom, or flip education; a concept that includes providing a video of the lesson online. Students download the lesson remotely while at home, watch the lecture, can pause, reflect, rewind and watch again. The classroom time is then used for more in-depth study, homework, questions and interaction between the students and teachers.

Public Safety: Our first responders need reliable, ubiquitous coverage, higher standards than what our commercial networks currently have, interoperability between networks and priority access to information and databases.

Emergency response teams have unique needs and higher standards for broadband and communications. Our first responders need networks that are reliable, always on, secure, provide ubiquitous coverage, interoperability between network and priority access to information and databases. Their devices need to be small, lightweight, versatile and autonomous, wearable and portable. The devices need to be capable of sensing the environment, of tracing and tracking resources and able to convey a wealth of information to other responders, civil protection authorities and to crisis management centers. Sensor-nets can provide for situational awareness for disasters, fires, emergencies, car wrecks and other events, but these sensors require access to high bandwidth and the current wireless networks do not currently support these applications adequately.

Police officers are ready to trade in their handheld radios for use of their iPhones, iPads, and Android devices while on the job. Until recently, this has created a problem for law enforcement agencies as smartphones and tablets haven't been able to connect to conventional Land-Mobile Radio (LMR) networks. U.S. public safety agencies will soon be able to use the FirstNet network that provides priority access for law enforcement, first responder and public safety agencies. This is critical during disasters when cell phone networks can become congested, as FirstNet is a network that will have spectrum dedicated exclusively for public safety entities.

Additionally, most devices for law enforcement include video applications – camera-equipped police and camera-equipped cars, cameras on traffic stops and enforcement of speed sensors and speeding tickets, and live ambulance video-links to hospitals. The existing wireless networks cannot support the applications that are in use today. The 911 system cannot process videos from citizens, but as we are finding during emergencies, the public is often the "eyes and ears" during these crises as citizens are videotaping events as they happen. Having the public be able to record events and send the information to first responders allows for better transparency, honesty and less mistakes.

Digital Inclusion and Civic Engagement: The Great Equalizer between the Haves and the Have-nots.....or Not?

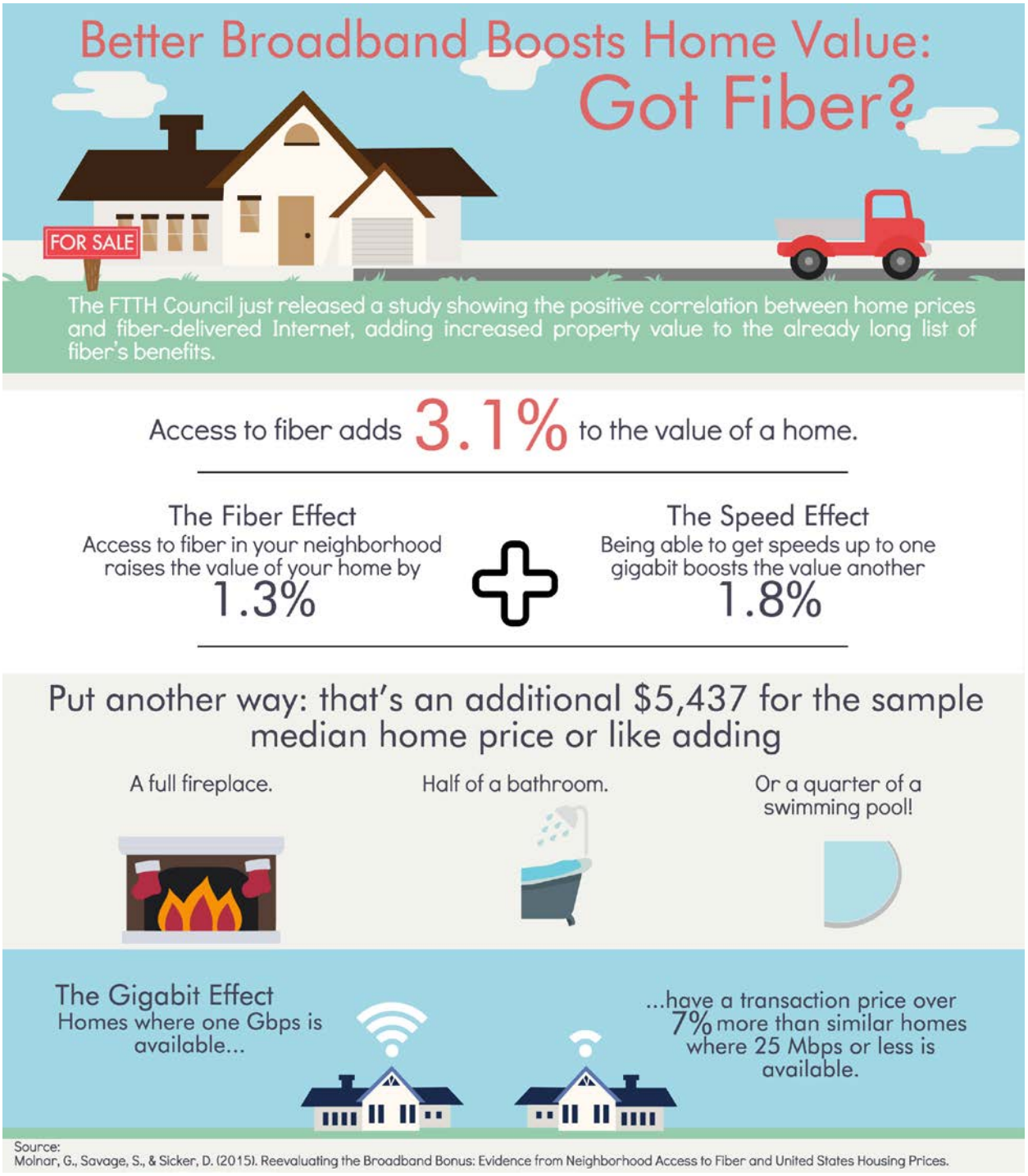
Broadband must be ubiquitous or it will further create a digital divide between the haves and the have-nots. When broadband is ubiquitous it can be the great equalizer between different economic classes. In 2014, the International Economic Development Council asked economic development professionals if broadband service could "encourage individual entrepreneurship among under-served constituents," and 35 percent said that it is quite likely and 14 percent said that they had seen it firsthand (see Table 4). Ubiquitous broadband access can help create social equality. However, not having advanced broadband access available to everyone can create further inequalities of wealth and potentially can create further gaps in education, social institutions and government resources. Broadband must be abundant, redundant and available to everyone.

Civic Engagement, Transparency, Access to Government Resources.

Advanced Broadband Networks can transform civic engagement, access to government resources and transparency of government. All government documents, including GIS data, applications, information on initiatives, information on financial contributions etc. are now available on-line. Documents must be able to be in a standardized format, searchable and available where data can be edited and used by other programs. Providing citizens access to this data provides further transparency, community engagement, public input, and public impact on government.

Higher Home Values

Finally, statistics from the FTTH Council state that real estate developments communities that have deployed FTTH networks have instantly improved home sales values. According to the FTTH Council, access to fiber adds 3.1% to the value of a home and having a Gigabit available increases home values by 7% over homes that have access to 25 Mbps or less. In Estes Park, the average home price is $560,000. A 7% homes value increase translates to $39,200.


Better Broadband Boosts Home Value:
Got Fiber?
FOR SALE
The FTTH Council just released a study showing the positive correlation between home prices and fiber-delivered Internet, adding increased property value to the already long list of fiber's benefits.
Access to fiber adds 3.1% to the value of a home.
The Fiber Effect
Access to fiber in your neighborhood raises the value of your home by
1.3%
The Speed Effect
Being able to get speeds up to one gigabit boosts the value another
1.8%
Put another way: that's an additional $5,437 for the sample median home price or like adding
A full fireplace.
Half of a bathroom.
Or a quarter of a swimming pool!
The Gigabit Effect
Homes where one Gbps is available...
...have a transaction price over 7% more than similar homes where 25 Mbps or less is available.
Source:
Molnar, G., Savage, S., & Sicker, D. (2015). Reevaluating the Broadband Bonus: Evidence from Neighborhood Access to Fiber and United States Housing Prices.

TELLER COUNTY WIRELESS, CELLULAR AND PUBLIC SAFETY PLAN

August 2016

Contents

Radio Frequency Analysis

August 10, 2016

Purpose

The Radio Frequency Analysis ("Analysis") serves as a general planning tool for Teller County ("County"). The analysis is intended to balance the goals of providing good wireless network services throughout the County while minimizing the visual impacts of the telecommunications infrastructure. Wireless network services include wireless broadband, cellular, and public safety applications. This analysis provides a short history on wireless telecommunications technology; an overview on network deployment practices; an inventory of existing wireless infrastructure throughout the County; theoretical propagation mapping; a ten-year projection of potential future network deployment patterns; and recommendations for meeting future network deployment objectives.

The analysis serves as an illustrative planning tool and guide for developing planning policies for future wireless communications infrastructure and identifies county owned and other public properties that can be part of network deployment solutions for service providers. This analysis can help establish policy for minimizing the future number of telecommunication facilities while maximizing network coverage objectives from as few new sites as possible.

Wireless Industry Stakeholders

Prior to the granting of the cellular licenses in 1980 for the first phase of deployment, the United States was divided into 51 regions by Rand McNally and Company. These regions are described as Metropolitan Trading Areas (MTA). The spectrum auction conducted by the Federal Government for the 1900 MHz bands for 2G (PCS), further divided the United States into 493 geographic areas called Basic Trading Areas (BTA). Teller County is located in the "Denver" MTA 22 (a.k.a. MTA 22) and the "Colorado Springs" BTA 89 (a.k.a. BTA 89).

The following personal wireless service providers have purchased licenses to offer broadband, fixed wireless, mobile radio, phone and or television in the low MHz frequencies (600-800): AT&T; Access 700, LLC; DISH; T-Mobile; and Verizon Wireless. Personal Communications Services (PCS) licensees and service providers for wireless phone and broadband operating in the high operating

frequencies 1700- 2600 include: AT&T Wireless; Atlantic Wireless, Clearwire, Commnet Wireless; Elliott School District #22; Hispanic Information and Telecommunications Network, Inc.; North American Catholic Educational Programming Foundation Inc.; Pikes Peak Community College; Sprint; T-Mobile; and Verizon Wireless.

Per Section 704 of the Telecommunications Act of 1996, all service providers will require uninterrupted and continuous handoff service throughout the County. Each of these wireless voice and data providers will need towers and/or above ground antenna mounting locations to improve network coverage and capacity equating to an ongoing need to deploy more infrastructure, especially in areas of greater residential density.

Most network service providers do not own the antenna mounting structure on which they attach their equipment. Tower owner companies typically construct the monopole, lattice or guyed tower and market that tower for lease space to the service providers. A service provider may also contract with a tower owner to obtain approval to construct a tower in a particular location and once the facility is constructed the service provider will then lease space from the tower owner on the newly constructed tower. There are four primary tower companies in the County who own and lease vertical real estate to the service providers: American Tower Corporation, Crown Castle International, SBA Communications Corporation and Vertical Bridge.

Existing Antenna Locations

The geographic study area for this analysis includes all of Teller County, any Personal Wireless Service Facility (PWSF) within 2-miles of the county boundary, and public safety facilities used by Teller County in Park, Douglas and El Paso Counties. Mapping the existing antenna sites creates a base map from which observations and analysis are derived relative to current and future deployment patterns. The County provided existing facility locations to NEO Connect and its subcontractor for this deliverable, CityScape Consultants. Other locations were attained from tower owners and the Federal Communications Commission (FCC) database, various antenna locator search engines or sites found in the field during the assessment process. CityScape assessed each of the existing antenna locations throughout the County to identify the following: 1) location of existing telecommunications facilities currently within and just outside the County; 2) tenants on the towers and rooftop; and 3) availability of future potential collocations on the existing structures.

The assessment is achieved through actual site visits to each facility. The wireless infrastructure assessment process identified fifty-two (52) existing wireless telecommunication facilities within the County. Table 1 provides a summary of the total number of types of antenna mounting structures found throughout the County as of June 30, 2016. Table 2 identifies the known ownership of the infrastructure and Table 3 summarizes the known height of the infrastructure.

CityScape was unable to access two locations due to locked gates which is why two (2) antenna mounting structures are identified as "Unknown" in Table 1. Twenty-five (25) facilities (nearly fifty percent) of the sites assessed have no identification of ownership or emergency contact information posted on the infrastructure. These assets are identified as "Unknown" in Tables 1, 2 and 3.

Type of Infrastructure	Total Number in Study Area (52)
Lattice Tower	29
Monopole Tower	3
Guyed Tower	5
Rooftop Attachment	4
Approved but not Constructed	1
Wood Pole	3
Metal Pole	1
Concealed	4
Unknown	2
Total	**52**

Table 1: Antenna /Tower Infrastructure Summary

Infrastructure Owner	Total Owned in Study area (52)
Crown Castle International	3

American Tower Corporation	8
Broadcast Companies	2
Public Entities	7
SBA	1
Vertical Bridge	1
Service Providers (AT&T, Commnet, Skybeam, T-Mobile)	4
Unknown	25
Proposed	1
Total	**52**

Table 2: Tower Infrastructure Ownership Summary

Tower Height	Total Number (52)
20’ - 60’	15
61’ - 100’	7
100’ - 150’	3
Unknown Height	26
Proposed	1
Total	**52**

Table 3: Tower Infrastructure Height Summary

Generally, most of the wireless infrastructure is located at higher topographical elevations, within and around the more populated areas of the County and parallel Highways 67 and 24. Geographic areas of Cripple Creek have larger concentrations of infrastructure because of the larger subscriber base from residents, tourists and the mining industry. There are six (6) clusters of towers within the study area. These cluster sites are known locally as Gold Hill, Badger Mountain, Mt. Pisgah, Mt. Pisgah Cemetery, Tenderfoot and Squaw Mountain.

Figure 1 identifies the location of the antennas throughout the geographic study area as follows:

Antennas mounted on towers are symbolized with a black dot •;

Antennas mounted on rooftops are identified by a yellow dot •;

Red dots • represent public safety facilities; and

Orange dots •identify proposed towers.

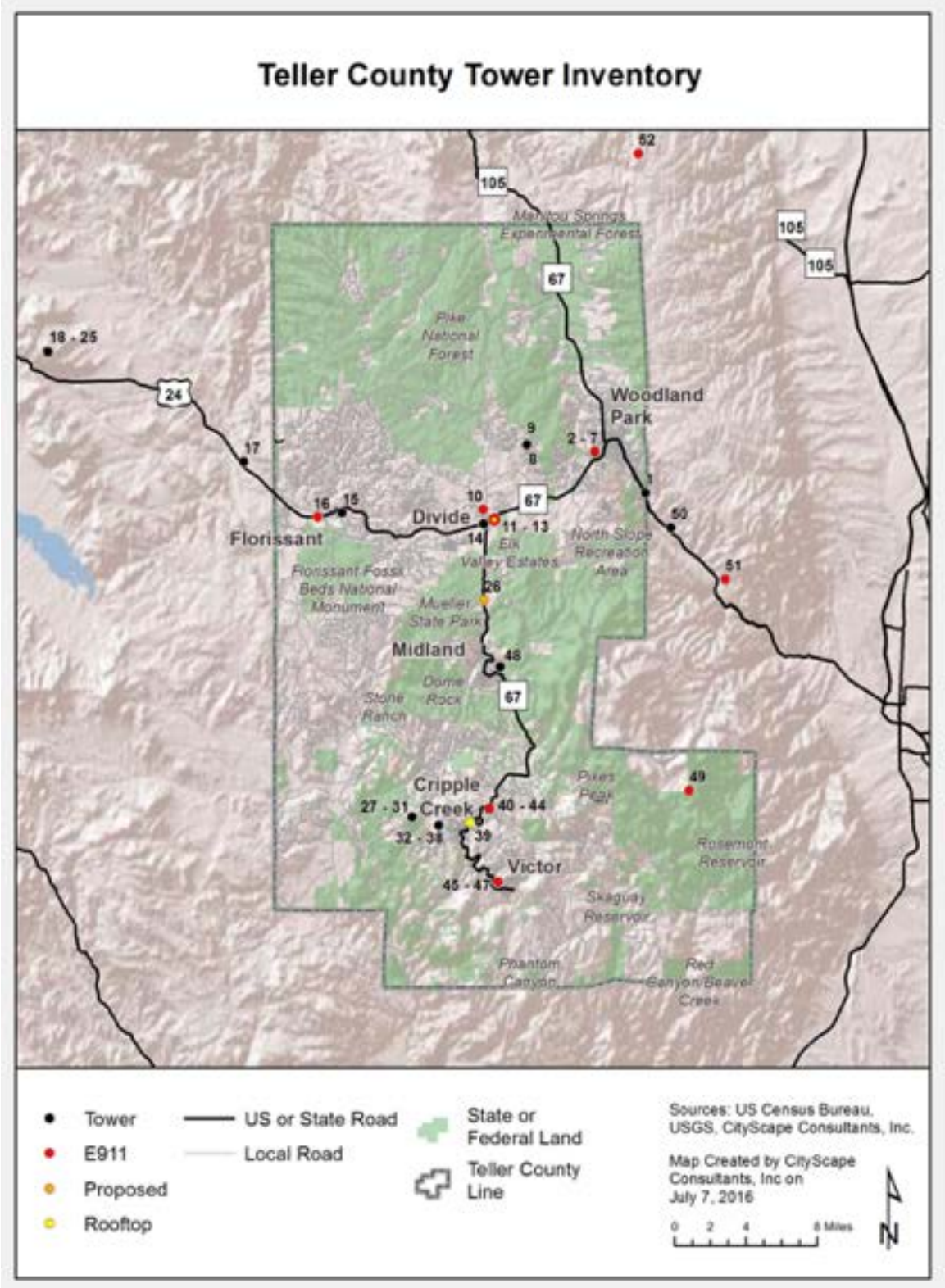


Figure 1: Map of Overall Existing Antenna Locations

Theoretical Composite Frequency Maps

The service area coverage based on propagation signal strength modeling is shown for both low band frequencies in yellow and high band frequency in blue on the following composite maps. The highlighted areas represent where a generally reliable signal level should be available for indoor use for both low and high bands of service. Indoor usage is the service threshold utilized for composite modeling because it represents the lowest signal strength acceptable after considering the signal loss that occurs from building penetration. Outdoor signal strength in the same area will usually be higher than indoor signal strength. Generally, the closer the subscriber is to the antenna base station, the more reliable the service. A subscriber further from the antenna base station will have less reliable service. As the subscriber gets closer to the edge of the yellow or blue area, the signal strength becomes more prone to degradation; particularly as usage in the area increases or environmental conditions worsen. Areas of gray on the map indicate where the subscriber will experience weak, unpredictable levels of signal strength, or no service at all. Filling in these coverage gaps would require the installation of additional antenna and corresponding construction of more towers or the identification of buildings that would serve as base stations.

Figure 2 illustrates current theoretical coverage for one service provider operating in the low or high band frequency *from the sixteen (16) sites containing personal wireless service equipment*. Four (4) of the sixteen (16) PWSF sites are located within several of the tower clusters and therefore only twelve (12) black dots are shown in Figure 2.

Figure 3 illustrates how maximizing the use of all fifty-two (52) sites within the study area will help to fill low and high frequency network gaps. Maximizing the use of these existing locations will mostly benefit the regions of Cripple Creek and Victor. The other areas of the County are still greatly underserved.

Both composite maps include the expected effects of terrain, vegetative cover, and current population density variables. The antenna mounting elevation in both figures is assumed to be at the top of the towers and base stations where the height is known or at 80 feet where height is unknown.

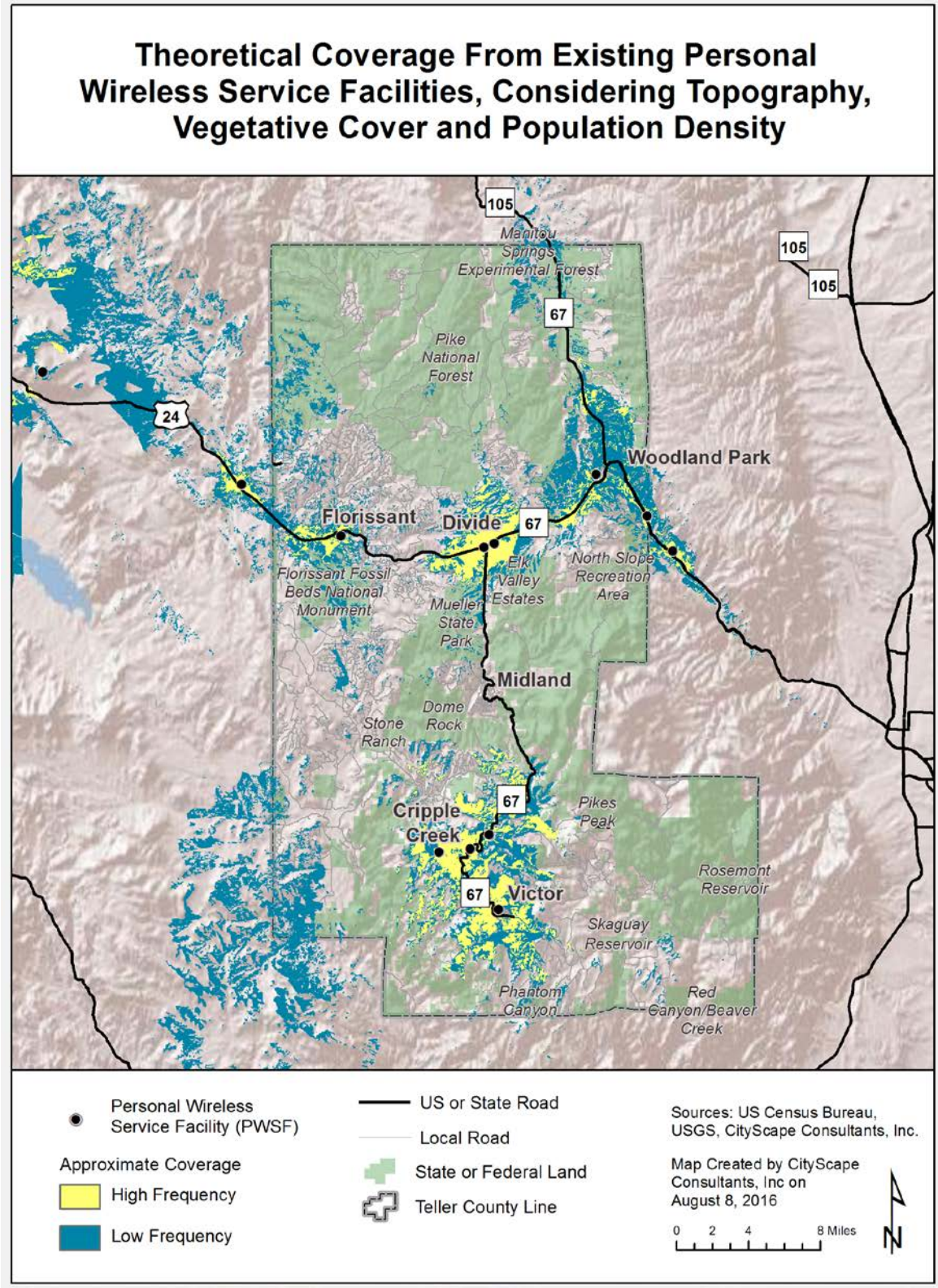


Figure 2: Theoretical Coverage From Identified 17 PWSF Locations Only

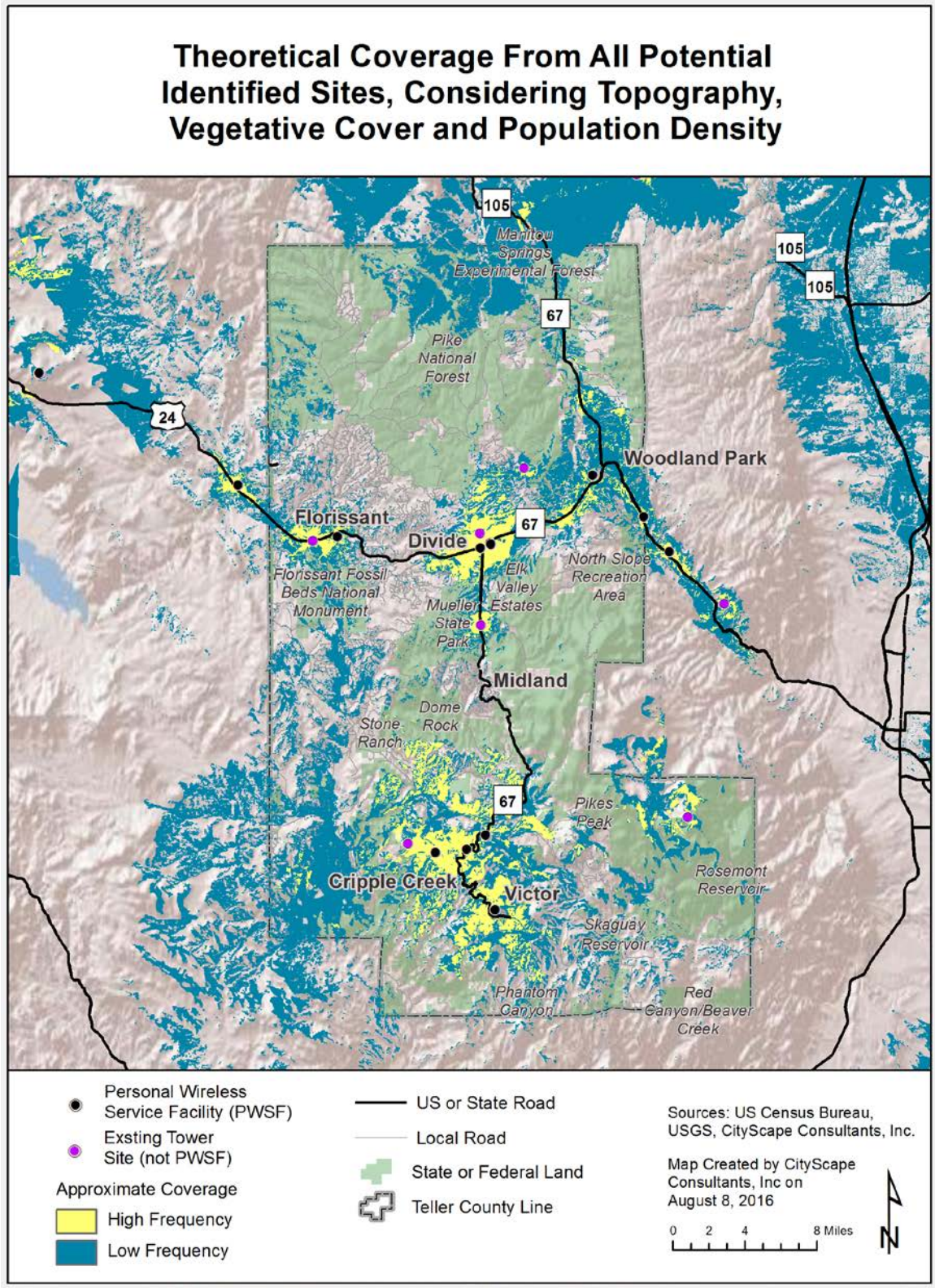


Figure 3: Theoretical Coverage From All 52 Identified Sites

According to the United States Census Quick Facts, the 2015 population estimate for Teller County was 23,385. This is a 0.1 percent increase from the 2010 census estimated census of 23,350. It is CityScape's understanding that the County does not anticipate much more of a population increase over the next five to ten years. The vast majority of the County is sparsely populated with less than 500 people per square mile. The only centers of population are in Woodland Park, Cripple Creek and Victor where greater than 4,000 people per square mile exists. Figure 4 reflects the population density throughout the County based on the data from the 2015 United State Census.

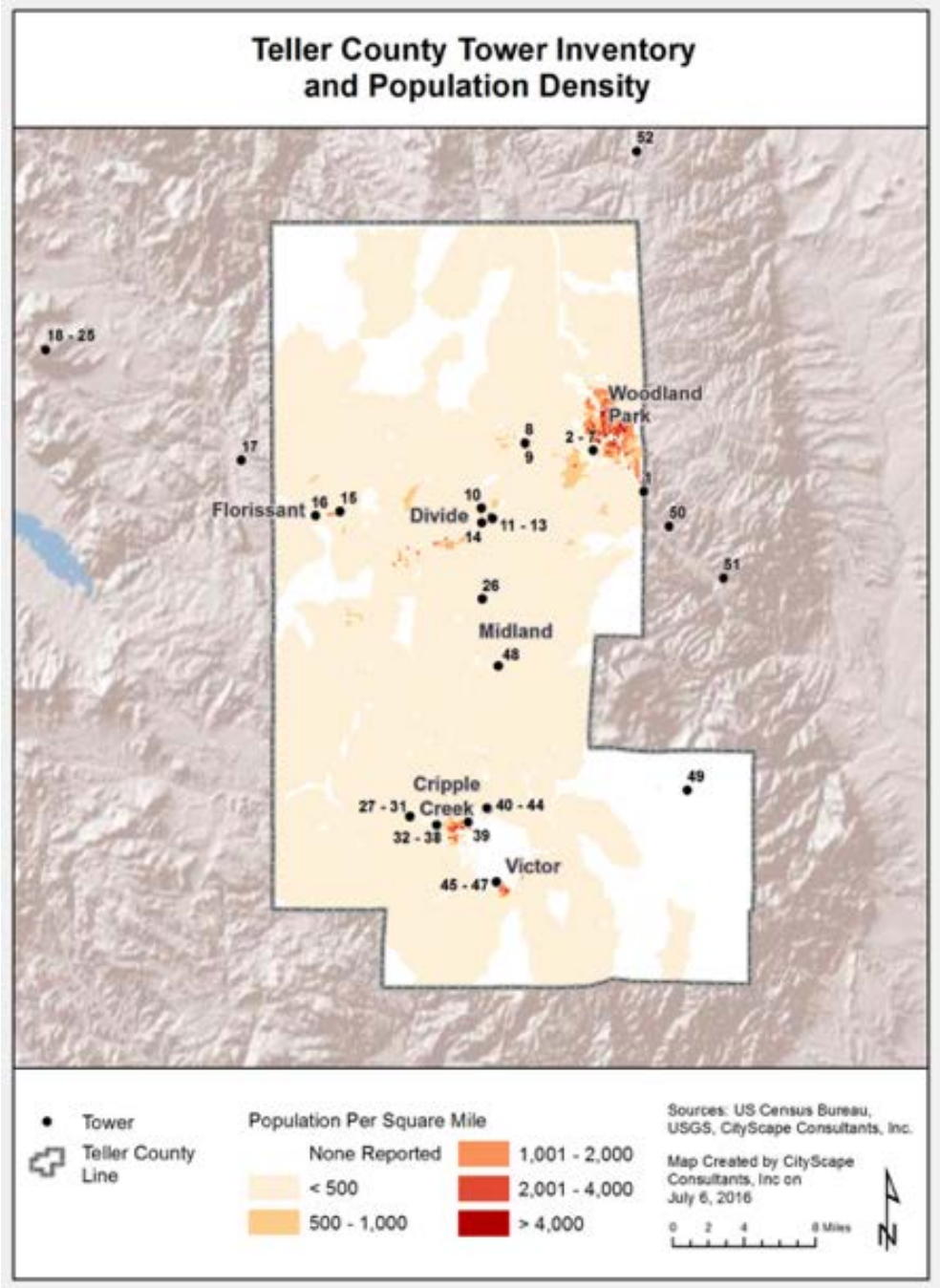


Figure 4: Teller County Population Density Per Square Mile 2015

Future Antenna Site Projections Through 2024

Modern and advancing technologies continue to change how the wireless industry is electronically providing their services. Newer technologies known as fourth generation (4G) Long Term Evolution (LTE) or high speed broadband requires more information to be sent and received within the same radio envelope than was used in the previous deployment stages of personal wireless services. The more data contained within the radio frequency envelope makes it more important than ever to have as much signal density as possible. Increasing signal density requires more wireless facilities. Proximity of the infrastructure to the subscribers is becoming ever more relative to optimizing network services.

While fifth generation (5G) remains in the future and the launch date is not known it will likely be prior to ten years. Fifth generation will implement true high-speed data with download speeds in excess of today's standard 25-megabit speeds. With broadband speeds in this arena, most all types of communications ((from VoLTE to computer direct) and entertainment (from former cable/satellite TV and radio to first run motion pictures) will all transition to wireless systems. To maintain data speeds, the number of subscribers, the distance from the wireless source and the type of data will be the primary design criteria.

Recommendations

To effectively and efficiently provide network coverage throughout the County over the next ten years, CityScape anticipates it will require around twenty (20) additional locations to provide a comprehensive network to fill in the service coverage and capacity gaps. The projections include low and high frequency coverage and capacity objectives and broadband network objectives. The mapping for this includes terrain, population and a proposed maximum 80-foot infrastructure height variable. The projection model designed by CityScape factors in existing antenna support structure locations (towers, rooftops, tanks and utility poles) for maximum collocation opportunities in an effort to reduce the number of new multiple towers within the same geographic areas.

Studying the maps in Figures 2 through 4, CityScape theorizes from a network coverage objective, the population in Teller County can be well served by maximizing the use of all existing tower locations with low and high frequency antennas in all areas except Woodland Park. Currently there are only two (2) PWSF sites in Woodland Park and almost half the county population is in and around this area. Consequently, Woodland Park will need more infrastructure, aside from the sites on Gold Hill, to adequately cover the Town.

As public sites are developed, the infrastructure installed becomes the precedent of how future sites should be developed on private land. Leasing public-owned lands assures the community the preference of concealment materials and technologies presently available to the industry. For example, many "slick sticks" and "flag pole" towers are available to the industry, as well as other creative ideas for concealment towers; some options are more aesthetically pleasing and practical than other types. Aslocal government utilizes these products, their applications become the standard for future tower sites on both public and private land. As public land sites are considered and utilized for these purposes, staff gains invaluable knowledge on how wireless sites are constructed, which will aid them in reviewing and processing future site plan designs and evaluations on both public and private properties. Leasing public lands for purposes of new wireless infrastructure can create new sources of public revenue. As new sites are developed on public land, the community generates lease revenue from that tower owner and tenant.

The County has affirmed their interest in maximizing the use of publicly-owned lands to fill in network gaps. Not all of the publicly-owned properties are located within coverage gap areas. Of the twenty (20) geographic gaps identified, approximately eight (8) of those gaps can be filled by using publicly-owned lands. Figure 5 shows the theoretical coverage improvements from the potential new eight (8) public land locations and the existing fifty-two (52) locations.

Table 4 provides of list of the public lands for consideration by the County to fill in network gaps. Fourteen (14) public properties are listed in the table, however only eight (8) are necessary for fill-in. There are four (4) potential public properties in two geographic regions that could be used to fill in the gap. Only one (1) property in each region is necessary and the underlying jurisdiction and tower owner and/or service provider should pick the one from the list in Table 4 (Letters C and H) that is most desirable.

Figure 6 specifically identifies the potential public properties identified in Table 4.

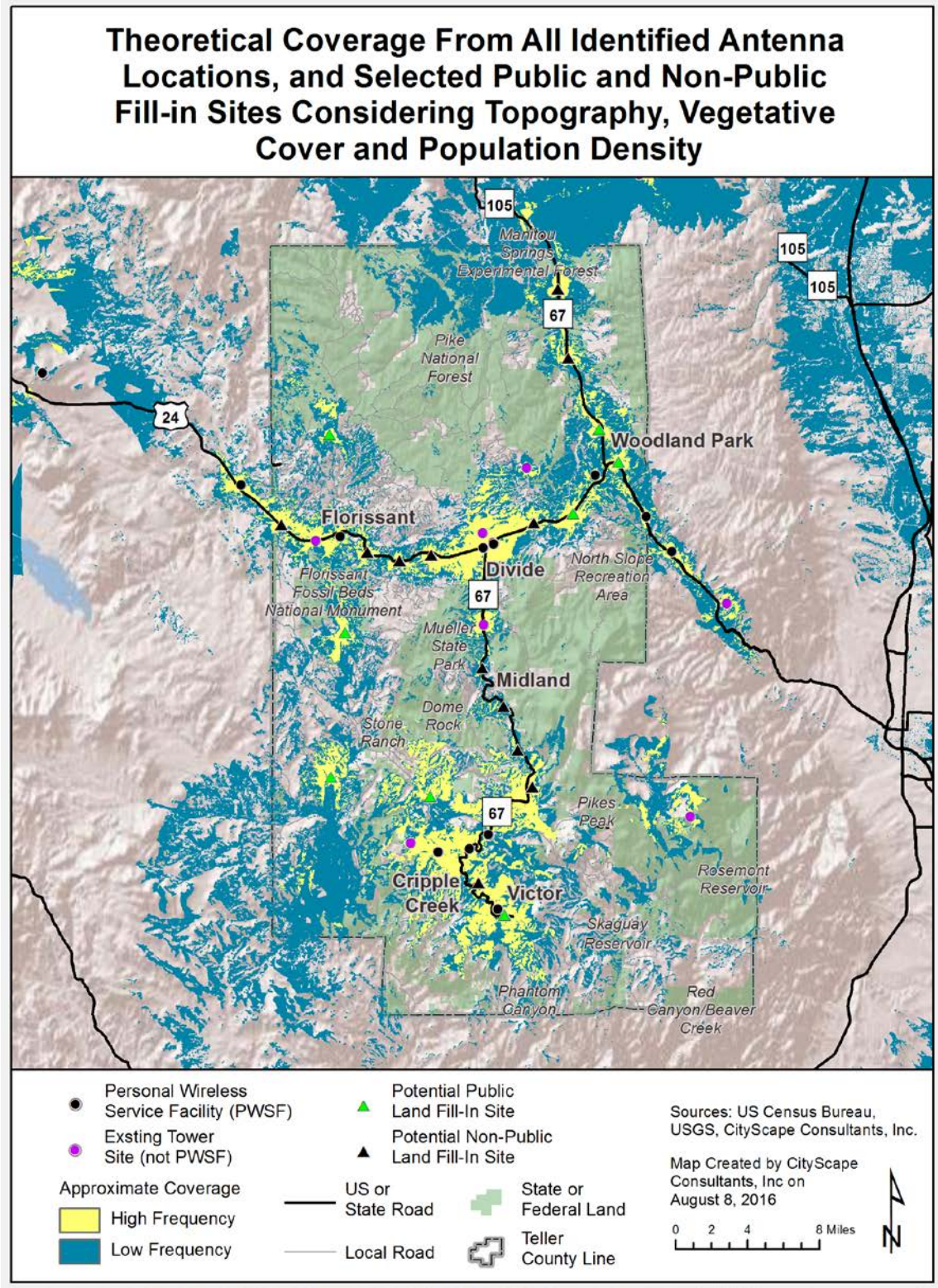


Figure 5: Theoretical Fill-in Sites

Public Land Site ID	Public Land Site Name	Public Land Site Address	Latitude	Longitude
A	Florissant Fire And Rescue Station 3	3204 Trail Creek Road Florissant, CO 80816	39.01187452	-105.2830483
B	Woodland Park Police Department	911 Tamarac Parkway Woodland Park, CO 80863	39.01500754	-105.0662742
D	Northeast Teller Co Station 3	35 Edlowe Road Woodland Park, CO, 80863	38.96239266	-105.0873193
E	Florissant Fire And Rescue Station 2	49 North Mountain Estates Florissant, CO 80816	38.88785462	-105.2705083
F	Fourmile Fire Station 1	8437 County Road 11 Florissant, CO 80816	38.79711295	-105.2820631
G	Four Mile Fire Prot Dist 2	142 Anges Drive Cripple Creek, CO 80813	38.78502815	-105.2021203
Pick one (1) of the “H” properties				
H1	Teller County Sheriffs Office Substation	500 Victor Avenue Victor, CO 80860	38.710525	-105.142458
H2	Victor Fire Dept	500 Victor Avenue Victor, CO 80860	38.71052311	-105.1423841
H3	City Of Victor	500 Victor Avenue Victor, CO 80860	38.71052311	-105.1423841
H4	Victor Police Department	500 Victor Avenue Victor, CO 80860	38.71052311	-105.1423841
Pick one (1) of the “C” Properties				
C1	City Of Woodland Park	220 West South Avenue Woodland Park, CO 80866	38.99476193	-105.0507177
C2	Gateway Elementary School	100 Panther Way Woodland Park, CO 80866	38.9942947	-105.0456874
C3	Woodland Park Re-2	211 North Baldwin Street Woodland Park, CO 80866	38.99608834	-105.0455239
C4	Woodland Park High School	151 North Baldwin Street Woodland Park, CO 80863	38.994872	-105.0451403

Table 4: Potential Publicly-Owned Lands for Gap Fill-in

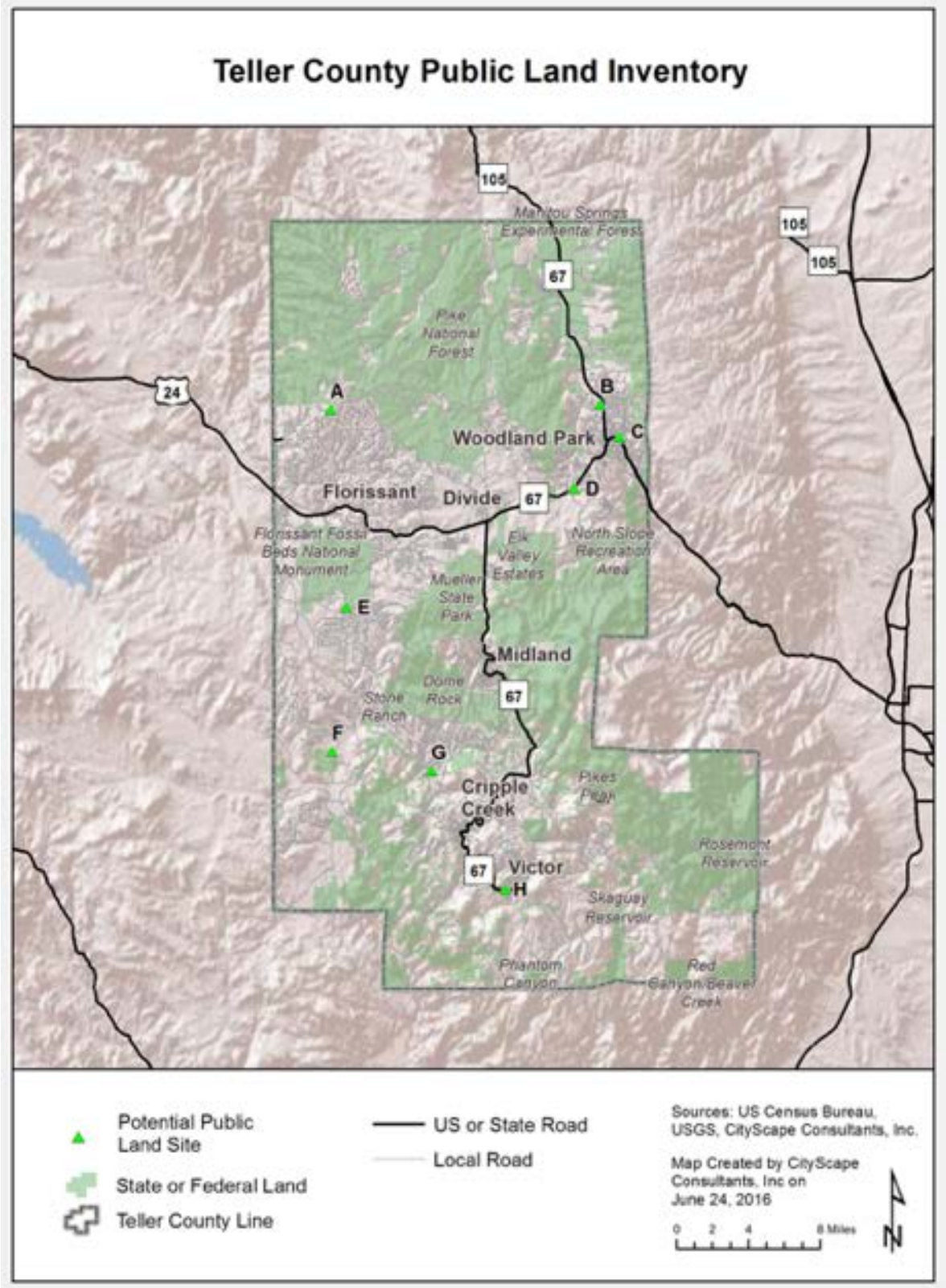


Figure 6: Identified Publicly-Owned Site Fill-in Site locations

Maximizing the use of the existing antenna locations, the identified eight (8) public land sites and twelve (12) other private land fill-in sites will still leave gaps in network coverage. The residential subdivisions in Teller County are highly correlated to address points, however the County does not have populations for each subdivision. Therefore, the address points were used as a quantifier of who is outside the fill-in coverage gaps. There are approximately 20,100 addresses and 23,400 people accounted for in residential subdivisions throughout the County equating to an average household size of 2.6. With that said, CityScape's public and private land network fill-in scenario covers 15,700 of the addresses and leaves 4,400 addresses possibly uncovered in the gap analysis.

The Figure 7 gap analysis is a visualization of geographic areas not covered by the network fill-in scenario and shows centralized locations for residential neighborhoods. The values in italic represent the number of addresses in the area that would experience either sub-standard or no coverage from any existing or proposed public or private fill-in sites. There are no public properties represented in these areas that could be used to fill in these gaps. Currently the subscriber base is low and will not likely meet the commercial service provider's business model for a new site in these areas at this time.

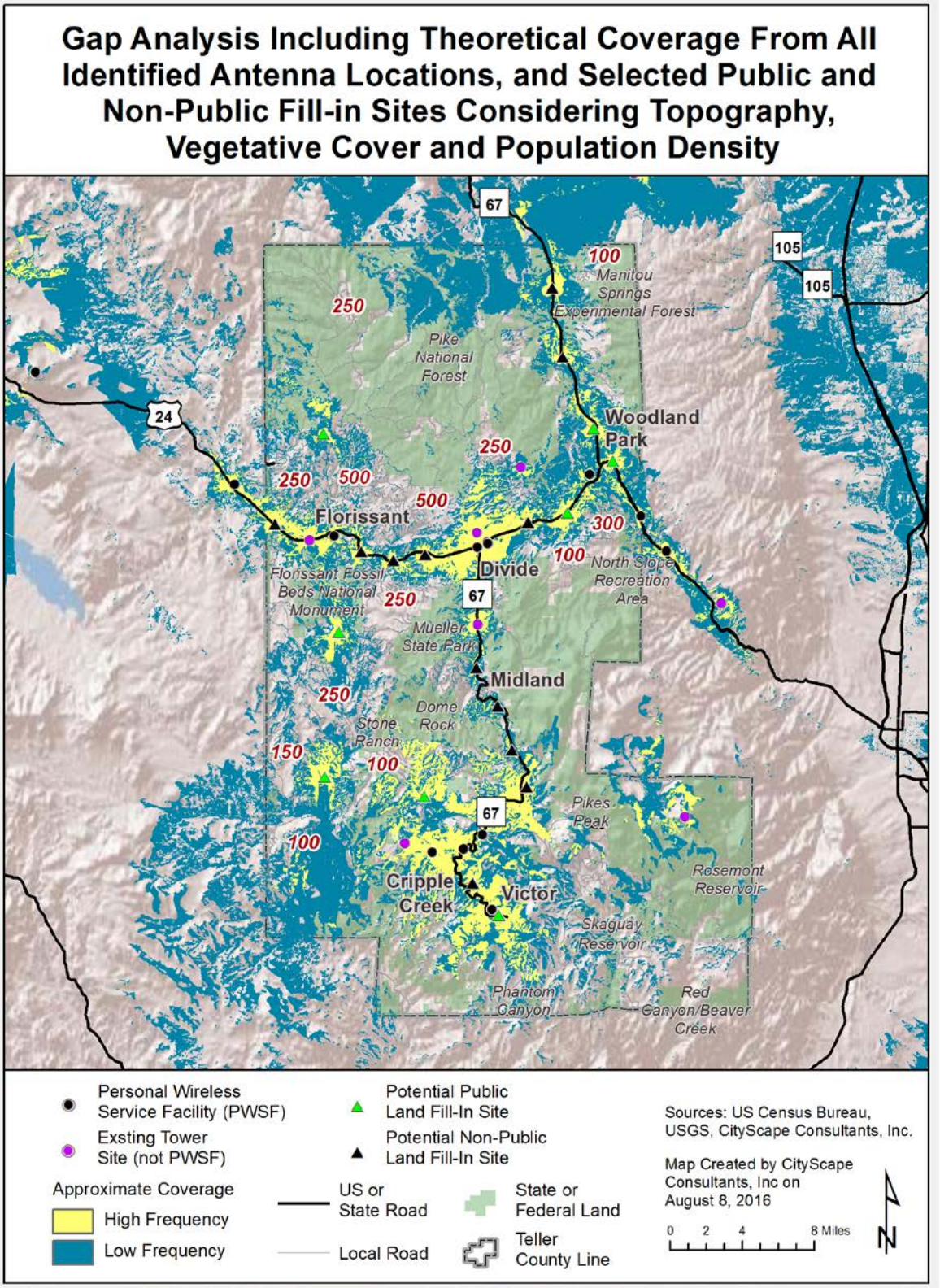


Figure 7: Gap Analysis

With the exception of Midland, the areas in and around the towns and paved corridors are served by a wireless signal. The most noticeable service gap along these corridors is along Route 67 between Divide and Cripple Creek. Four to five (4-5) new sites will be needed to serve this corridor, which will require closer than normal spacing due to the rugged terrain. The Town of Victor would benefit from one additional site. While service in the heavily populated Woodland Park area is minimal it is acceptable at this time. Additional, future sites will be required to handle the increasing broadband use which is why CityScape anticipates at least two (2) more sites will be necessary for capacity relief.

Areas north of Florissant and western Teller County Rd 1 appear to be underserved. It is not likely that cellular providers will propose new sites to serve these areas anytime soon. The higher priority areas that are adjacent to existing service areas will likely gain relief before the more remote areas. Personal wireless service companies tend to serve well-travelled corridors, thus the areas along Teller County Rd 1 may be next, however, projected growth could be many years away.

A common option that could provide more rapid access to service would be to have a non-cellular broadband provider construct a microwave point-to-point network to serve these remote areas. This type of network would require a high elevation such as a peak with available power. Once the remote area is interconnected via microwave link(s) the service is distributed to the surrounding nearby areas through a broadband antenna, similar to how a cellular tower operates. Implementation of this type of network would be at a higher cost and the cost would be that of the end user, in this case the County. The only remaining option might be individual subscriber satellite service.

The County could also consider partnering with a service provider who owns spectrum or has access to spectrum agreements to provide network coverage in remote geographic areas via traditional funding sources, public/private partnerships or applying for mobility funds. First Responder Network Authority (FirstNet) is a possible stakeholder in Teller County. CityScape does not have access to the FirstNet build out plan and cannot project anticipated sites. The public/private partnership for the next round of mobility funding may be a more viable solution to improving emergency services, broadband and personal wireless service networks.

The site assessment process revealed two (2) towers that appear to be abandoned. Per the County's Land Use Regulations AB-10, "If a low power communication facility ceases operating for 6 consecutive months, the facility owner or operator shall remove it within 90 days, and any conditional use permit approving the communication facility shall expire." At any time, the Planning Director may request a letter from the applicant certifying that the facility is in use and the use has not been discontinued for 6 consecutive months. If the facility is not removed within 90 days, a letter will be sent to the land owner and/or the communication company providing 60-day notice that a lien will be filed on the property equal to the cost of removing the facility and associated clean up. Appeal of the Planning Director's determination may be made to the Planning Commission at any time within the 60-day notice period." CityScape recommends an inquiry to the tower owners regarding the discontinued use of the infrastructure.

CityScape further recommends zoning changes to the Land Use Regulations that aligns the County with the recent mandate as provided in Section 6409 of the Middle Class Tax Relief and Job Creation Act of 2012 and subsequent FCC rulemaking decisions. Additionally, CityScape would recommend including language that promotes the use of public lands as fill-in sites for network coverage.

Lastly, CityScape strongly encourages the County require all existing and future tower owners install contact identification signage on each facility. Most of the towers assessed did not exhibit adequate ownership or tenant contact information. Proper identification should be maintained for purposes of emergency as well as potential interest in collocation to maximize the use of existing infrastructure.

Appendix A Wireless Facility Inventory

Procedure
CityScape conducted an assessment of the existing antenna locations throughout Teller County by driving to all locations. Data for the assessments was obtained from a number of sources, including actual permits obtained from the County for wireless infrastructure, research of FCC registered site locations, direct information from existing wireless service providers and tower owners active in the County, County GIS, and through on-site visits to each location.

Structural Evaluation
Based on a visual inspection of antenna arrays already on existing structures, CityScape made an evaluation as to whether each support structure is likely to physically accommodate more antennas. The number of estimated collocations is referenced as future antenna collocation possibilities. The suggested number of collocations is based on visual observations only. In this consideration, adding antennas equates to adding other wireless antenna platform(s) consisting of several antennas and associated coaxial cable. Prior to mounting new antennas and related equipment, the structure must be examined and analyzed by a structural engineer for its ability to support the proposed addition(s).

Site Photographs
Photographs of the exiting antenna are provided for most of the sites.

Categorization
The criteria used to choose the sites is specific to the definitions as defined by the October 2014 Federal Communications Commission (FCC) Report and Order on Improving Wireless Siting Policies. The definition of "tower" includes any structure built for the sole or primary purpose of supporting any Commission-licensed or authorized antennas and their associated facilities. Types of towers include monopoles, lattice and guy towers used for personal wireless service facilities such as Verizon, AT&T, etc. microwave, emergency services and/or broadcast. The definition of "base station" is the equipment and non-tower supporting structure at a fixed location that enables Commission-licensed or authorized wireless communications between user equipment and a communications network. For example, an antenna attached onto a rooftop or water tank is a base station.

Sites in the inventory are further categorized as personal wireless service facility PWSF; meaning, the antenna on the tower or base station is used by a wireless service provider to provide wireless telephone to a paid subscriber base.