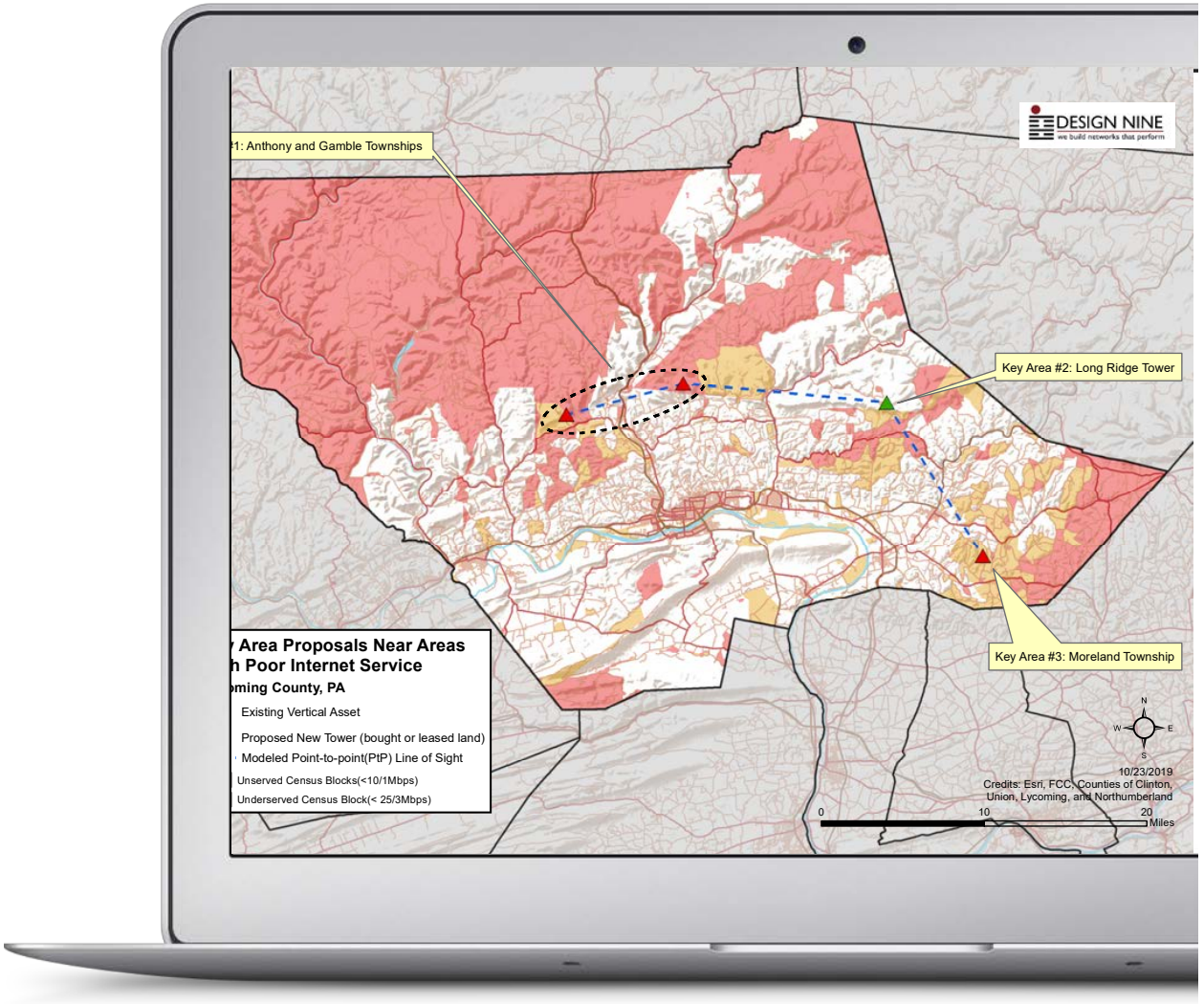
# LYCOMING COUNTY

## Broadband Asset and Service Analysis and Strategies




DESIGN NINE
broadband planners

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# ACKNOWLEDGEMENTS

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# 1 SUMMARY

A broadband study of Clinton, Lycoming, Northumberland, and Union counties was commissioned by SEDA-COG and completed during the summer and fall of 2019. The study included meetings with stakeholders and interested parties in each county, interviews and meetings with businesses, meetings with county official in each of the four localities, and residential and business broadband surveys.

There are five separate documents that comprise the work:

- **Broadband Assessment and Plan** – This report includes a full summary of the survey results, a discussion of future broadband needs, an analysis of current and future technology systems to deliver broadband and Internet, ownership options for county and/or regional ownership of broadband infrastructure investments, funding and grant options for funding broadband initiatives, and legal and regulatory issues.
- **Clinton County Broadband Asset and Service Analysis and Strategies**
- **Lycoming County Broadband Asset and Service Analysis and Strategies**
- **Northumberland County Broadband Asset and Service Analysis and Strategies**
- **Union County Broadband Asset and Service Analysis and Strategies**

This report on Lycoming County includes:

- **Asset Maps** – Demographic data, tower and fiber assets in the county, underserved and unserved areas of the county, and geo-coded survey results.
- **Service Provider Analysis** – A review of current service provider service offerings, speeds, and prices for those services.
- **Key Area Fixed Point Wireless Projects** – Three underserved areas of the county were identified and a fixed point wireless project for each area is described, including cost estimates and maps.
- **County-wide Fixed Point Wireless Project** – As an appendix, a county-wide fixed point wireless project is described and includes detailed cost estimates and maps. Each of the fiber pilot projects has been located with projected line of sight to a tower in this design.

Lycoming County has large areas designated as "unserved" using FCC (Federal Communications Commission) data. Most of those areas in the northern part of the county, with smaller areas in the eastern and southern areas of the county. The center of the county is largely served, but has many pockets of underserved and unserved areas. In the more rural parts of the county designated as underserved and unserved, fixed point wireless broadband is going to be an important strategy for improving Internet service for some years.

Based on the large areas designated as unserved and unserved, it seems unlikely that the incumbent telephone and cable providers in the county are likely to make much investment in new infrastructure other than minor incremental additions to their current network.

The County government should not become an Internet provider. Instead, it should focus on developing public/private partnerships by making targeted investments in basic broadband infrastructure like towers and dark fiber. These assets have long life spans of forty years or more and can be leased out to private sector ISPs (Internet Service Providers). While the revenue from the lease

agreements will be modest, the funds generated can be used to support maintenance of this infrastructure.

The Federal government has been steadily increasing the amount of grant funding available for broadband infrastructure, with USDA and HUD both having programs that are designed to help underserved and unserved areas construct new broadband infrastructure. As noted above, the Broadband Assessment and Plan document has much more information on these grant programs and other potential sources of funding, including strategies for funding infrastructure with local sources of funds.

# 2 LYCOMING COUNTY ASSETS

A wide variety of assets in Lycoming county are identified in the following pages.

The included maps provide detail on the following:

**Points of Interest** – This information is used to identify key users of Internet services that could benefit from improved broadband infrastructure in the county. K12 schools, public safety facilities, fire and rescue locations, health facilities, and county facilities are included.

**LMI/HUD Areas** – Low and Moderate Income (LMI) and HUD-eligible areas often qualify for certain kinds of grants not available to other areas.

**Towers** – Of particular importance are towers, which can be divided approximately into two categories: publicly owned towers and privately owned towers. As a general rule, WISPs (Wireless Internet Service Providers) have found that the lease fees to obtain space on cellular towers is too high to justify the expected revenue from broadband Internet customers in the area around that tower. To improve broadband Internet coverage in rural areas of the four counties, some new towers are going to be needed, with very modest lease fees–to attract WISPs onto those towers.

The fixed point wireless network designs make the assumption that as a general rule, access to space on the cellular towers is too expensive, and so some new towers will be needed even where there may be an existing privately owned tower. If funding is developed for one or more of the county-wide wireless networks (or a portion of one of the county-wide networks), an early and important step would be to assess space availability on existing towers where the design has specified a tower. If some existing towers can be used rather than building a new tower, there would be significant cost savings.

**Fiber Routes** – In most areas of all four counties included in the study, fiber routes are typically long haul routes passing through the county to other major metro areas and/or connecting only a few institutional and enterprise customers. They are typically not designed to support fiber to the home or business.

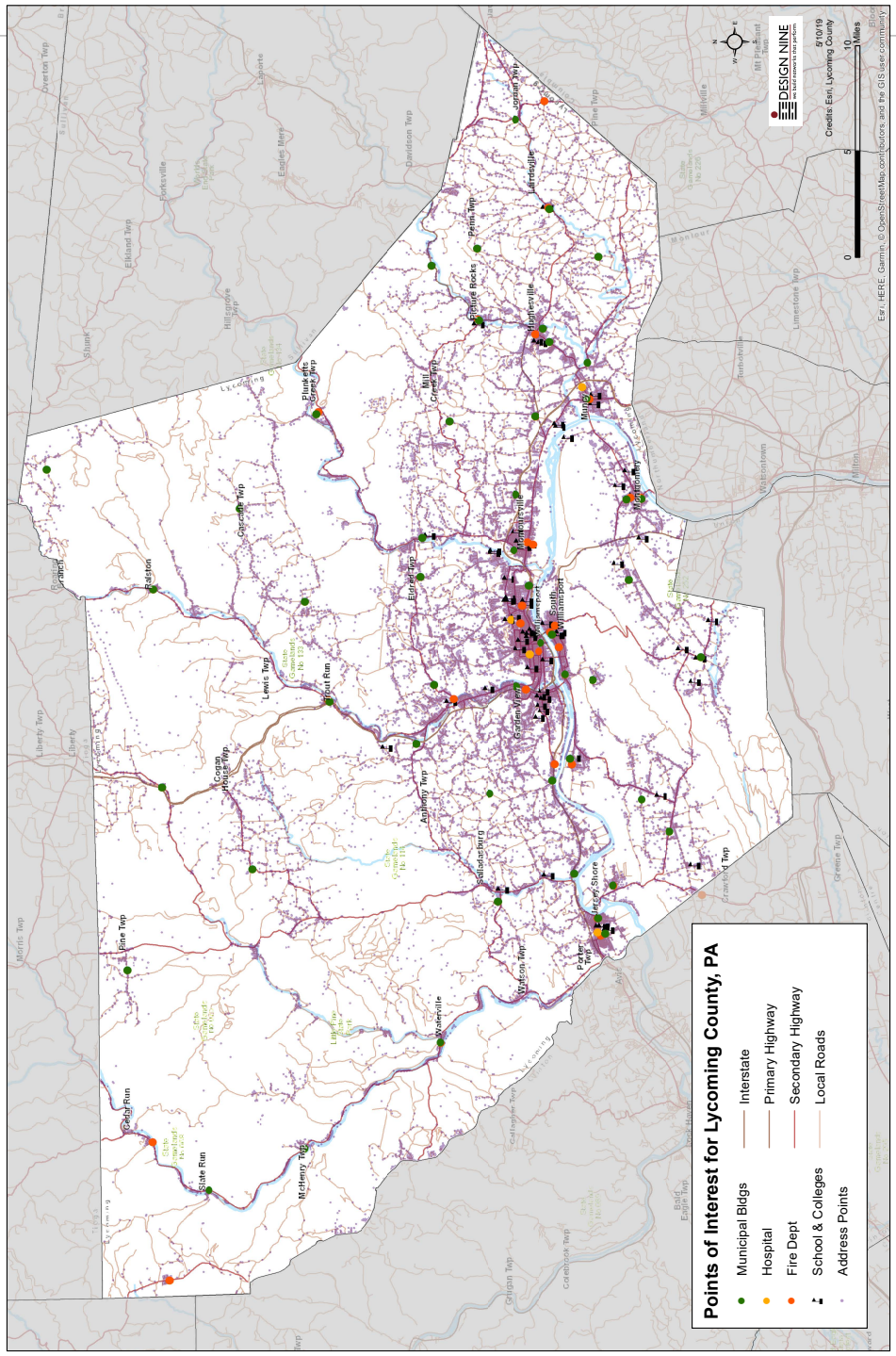
**Service Levels** – This map illustrates information on served, underserved, and unserved areas in the county obtained from FCC 477 reports. The data is self-reported by the service providers.

**Survey Satisfaction and Speed** – These maps show residential and business customer satisfaction and Internet speed data collected from the broadband survey conducted as part of the study. A complete summary of all data collected by the residential and business survey is contained in the separate Broadband Recommendations report.

**Penn State Speed Test Results** – A Penn State research project has collected speed test data submitted by Pennsylvania residents and businesses for several years. The charts in this sub-section show the median upload and download speeds (Megabits/second).

# 2.1 POINTS OF INTEREST

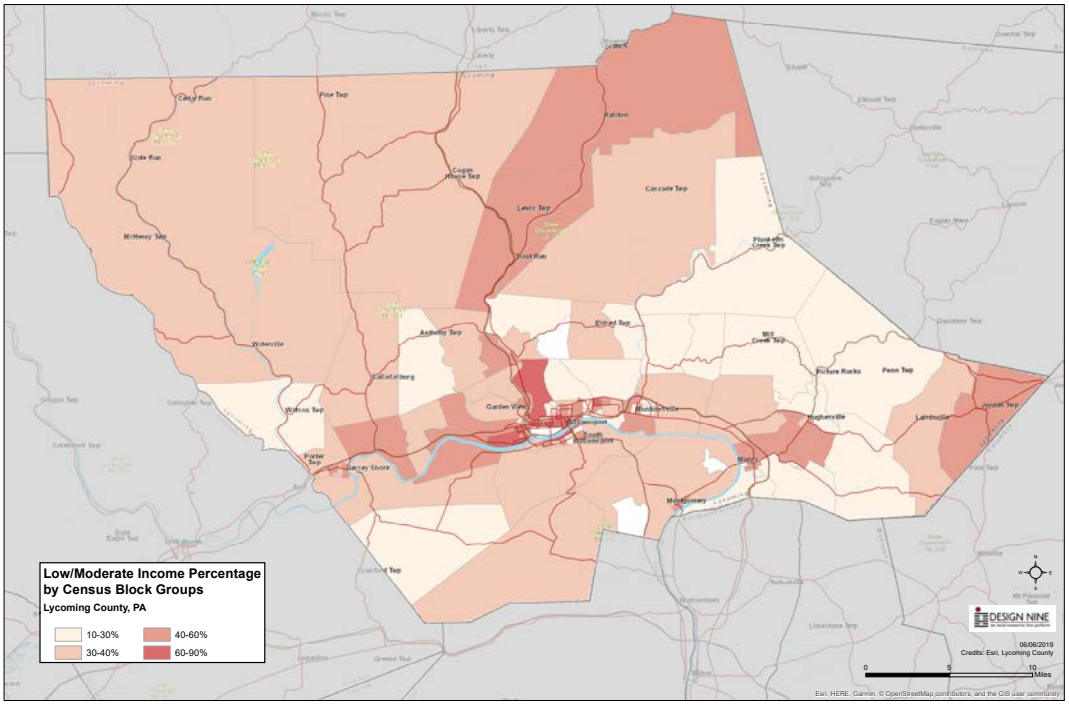
County facilities, municipal facilities, libraries, K12 and higher education facilities, fire and rescue stations, and public safety locations are all candidates to be anchor tenants for fixed point wireless and/or fiber services.

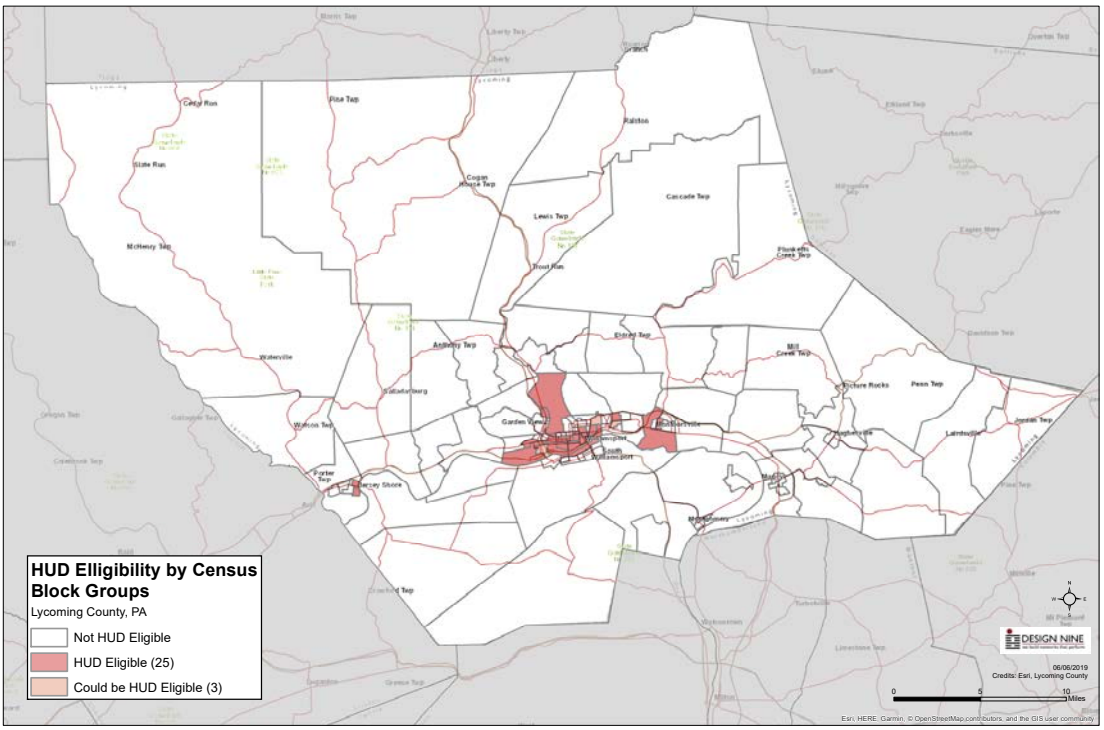


# 2.2 LMI AND HUD ELIGIBLE AREAS

HUD-eligible areas are determined by LMI (Low and Moderate Income) statistics—but can be different from census blocks in the county that meet LMI thresholds.

**HUD-eligible census blocks can qualify for CDBG funding for telecom infrastructure projects.**



# 2.3 TOWERS IN THE COUNTY

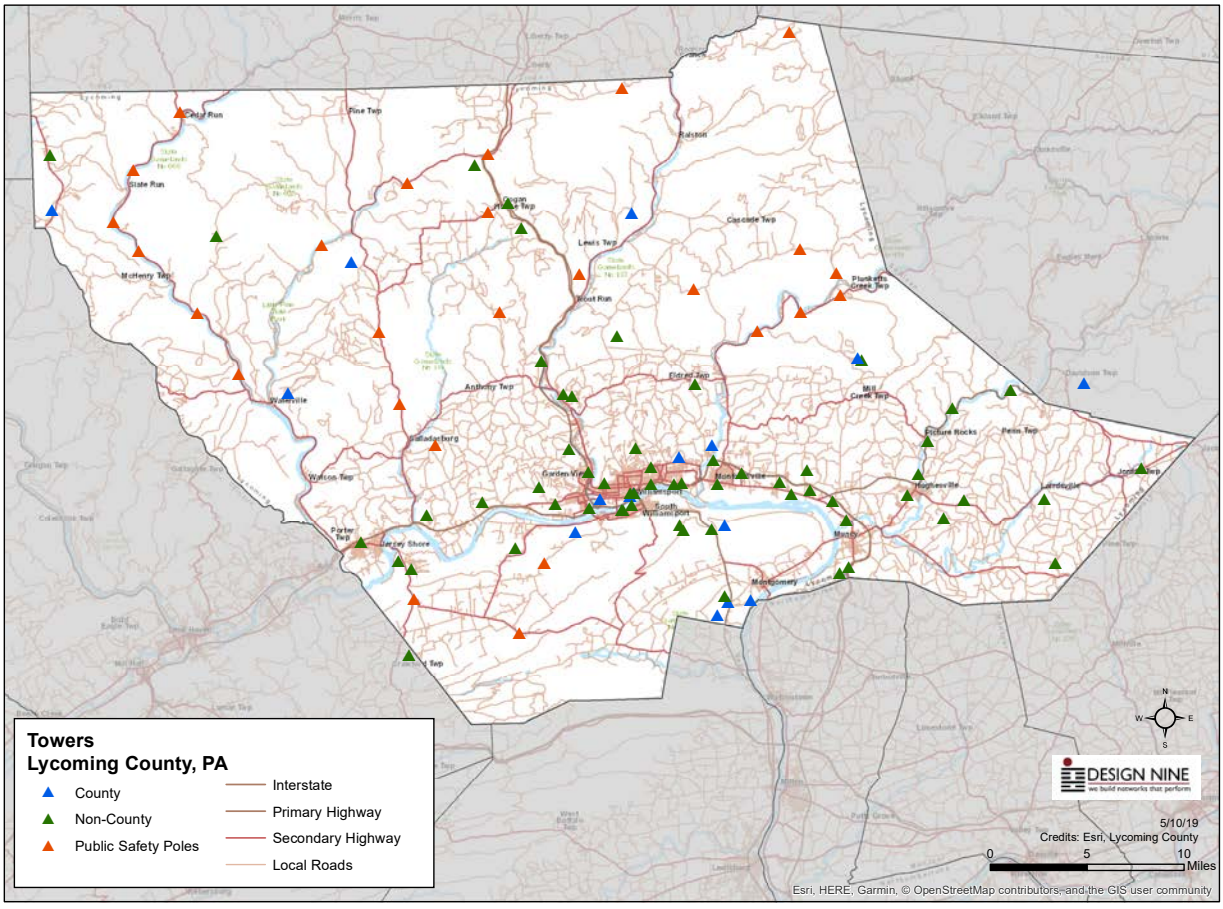
A variety of publicly-owned and privately owned towers are shown here. Tower data is collected from an FCC database, County data, and other publicly available sources. The FCC database usually includes most towers that are in a locality, and generally includes all or nearly all cellular towers.

Towers can be divided approximately into two categories: publicly owned towers and privately owned towers. Publicly owned towers can be owned by local government, by regional authorities, or by the state. In the county, privately owned cellular towers are the most common type of tower, and are generally clustered along major roadways and higher density population areas.

Many commercial towers, especially cellular towers, may have tower lease fees that are too high for a WISP (Wireless Internet Service Provider) to make a business case for putting fixed point broadband equipment on the tower. The cost to a WISP for getting on a privately owned tower often has to be checked on a case by case (tower by tower) basis.

To improve broadband Internet coverage in rural areas of the county, some new towers are going to be needed, with very modest lease fees—to attract WISPs onto those towers.

A second consideration for placing WISP equipment on a cellular tower is where space is available—that is, at what height? Space may be available at an affordable price, but the location on the tower may not be high enough to cover an area large enough for a decent number of customers.



| Name or Tower Category | Owner/Carrier | Street Address | Municipality/ Location | Longitude | Latitude |
|---|---|---|---|---|---|
| Public Safety Pole 800 MHZ Pole & Cell Tower | PA Statewide Radio Network/Verizon | 1569 NARROW MOUNTAIN RD | LEWIS | -77.05435473 | 41.40439780 |
| Public Satefy Pole 800 MHZ Pole LYCO682 | PA Statewide Radio Network | 5955 PINE RUN RD | MIFFLIN | -77.19806144 | 41.27780116 |
| Public Satefy Pole 800 MHZ Pole LYCO683 | PA Statewide Radio Network | 9996 LITTLE PINE CREEK RD | PINE | -77.30986467 | 41.42762489 |
| Public Satefy Pole 800 MHZ Pole LYCO684 | PA Statewide Radio Network | 214 LETONIA RD | BROWN | -77.45051838 | 41.52748628 |
| Public Satefy Pole 800 MHZ Pole LYCO685 | PA Statewide Radio Network | 9895 RT 414 HWY | MCHENRY | -77.49188828 | 41.42389183 |
| Public Satefy Pole 800 MHZ Pole LYCO686 | PA Statewide Radio Network | 9728 S RT 44 HWY | LIMESTONE | -77.11630572 | 41.13650070 |
| Public Satefy Pole 800 MHZ Pole LYCO687 | PA Statewide Radio Network | 39 RT 880 HWY | LIMESTONE | -77.22061577 | 41.16297452 |
| Public Satefy Pole 800 MHZ Pole LYCO688 | PA Statewide Radio Network | 775 PROCTOR RD | PLUNKETTS CREEK | -76.79905583 | 41.40344581 |
| Public Satefy Pole 800 MHZ Pole LYCO690 | PA Statewide Radio Network | 4461 ELLENTON MOUNTAIN RD | MCNETT | -76.84305643 | 41.58444438 |
| Public Satefy Pole 800 MHZ Pole LYCO691 | PA Statewide Radio Network | 4440 RT 284 HWY | PINE | -77.22433484 | 41.47402844 |
| Public Satefy Pole 800 MHZ Pole LYCO692 | PA Statewide Radio Network | 225 BLOCKHOUSE RD | JACKSON | -77.14419476 | 41.49483282 |
| Public Satefy Pole 800 MHZ Pole LYCO693 | PA Statewide Radio Network | 12661 RT 87 HWY | PLUNKETTS CREEK | -76.83477855 | 41.37500183 |
| Public Satefy Pole 800 MHZ Pole LYCO694 | PA Statewide Radio Network | 950 RT 414 HWY | CUMMINGS | -77.39302576 | 41.33200150 |
| Public Satefy Pole 800 MHZ Pole LYCO695 | PA Statewide Radio Network | 5105 RT 414 HWY | MCHENRY | -77.43371610 | 41.37752261 |
| Public Satefy Pole 800 MHZ Pole LYCO696 | PA Statewide Radio Network | 12015 RT 414 HWY | BROWN | -77.51690868 | 41.44515674 |
| Public Satefy Pole 800 MHZ Pole LYCO697 | PA Statewide Radio Network | 15049 RT 414 HWY | BROWN | -77.49727618 | 41.48427896 |
| Public Satefy Pole 800 MHZ Pole LYCO698 | PA Statewide Radio Network | 1907 SOUTHARD RD | BROWN | -76.94064367 | 41.39269090 |
| Public Satefy Pole 800 MHZ Pole LYCO699 | PA Statewide Radio Network | 11568 WALLIS RUN RD | BROWN | -76.83482853 | 41.42172575 |
| Public Satefy Pole 800 MHZ Pole LYCO646 | PA Statewide Radio Network | 3808 JACKS HOLLOW RD | BASTRESS | -77.09105554 | 41.18894440 |
| Public Satefy Pole 800 MHZ Pole LYCO645 | PA Statewide Radio Network | 821 RT 184 HWY | COGAN HOUSE | -77.14466664 | 41.45175183 |

| | | | | | |
|---|---|---|---|---|---|
| Public Satefy Pole 800 MHZ Pole LYCO628 | PA Statewide Radio Network | 10519 RT 287 HWY | COGAN HOUSE | -77.25344365 | 41.36248415 |
| Public Satefy Pole 800 MHZ Pole LYCO656 | PA Statewide Radio Network | 6452 RT 287 HWY | MIFFLIN | -77.23322221 | 41.30864013 |
| Public Satefy Pole 800 MHZ Pole LYCO657 | PA Statewide Radio Network | 8721 RT 287 HWY | PLUNKETTS CREEK | -76.87803722 | 41.36119779 |
| Public Satefy Pole 800 MHZ Pole LYCO658 | PA Statewide Radio Network | 14980 RT 87 HWY | PLUNKETTS CREEK | -76.79503406 | 41.38730799 |
| Public Satefy Pole 800 MHz Pole LYCO626 | PA Statewide Radio Network | 5342 ROARING BRANCH RD | MCINTYRE | -77.01019480 | 41.54401136 |
| Public Satefy Pole 800 MHz Pole LYCO614 | PA Statewide Radio Network | 4245 BOBST MOUNTAIN RD | COGAN HOUSE | -77.13363753 | 41.37697407 |
| Lycoming County Tower English Center | Lycoming County | 1841 HUGHES RD | PINE | -77.28072305 | 41.41514371 |
| Lycoming County Tower Pump Station | Lycoming County | 29263 N RT 44 HWY | BROWN | -77.57784274 | 41.45439728 |
| Lycoming County Tower Armstrong | Lycoming County | 2008 ARMSTRONG RD | CLINTON | -76.91230131 | 41.21635763 |
| Lycoming County Tower Shrivers Ridge | Lycoming County | 2400 BODINE MOUNTAIN RD | LEWIS | -77.00155453 | 41.45036813 |
| Lycoming County Tower Bald Eagle | Lycoming County | 1850 JACKS HOLLOW RD | ARMSTRONG | -77.06038528 | 41.21201953 |
| Lycoming County Tower Courthouse | Lycoming County | 48 W 3RD ST | WILLIAMSPORT | -77.00216766 | 41.24089258 |
| Lycoming County Tower DPS Lysock | Lycoming County | 542 COUNTY FARM RD | LOYALSOCK | -76.92411176 | 41.27616673 |
| Lycoming County Faxon Tower & Cell Tower | Lycoming County | 2060 FAIRVIEW RD | LOYALSOCK | -76.95692628 | 41.26750123 |
| Lycoming County Transfer Station | Lycoming County | 1475 W 3RD ST | WILLIAMSPORT | -77.03566600 | 41.23655800 |
| Lycoming County RMS Landfill Tower | Lycoming County | 447 ALEXANDER DR | BRADY | -76.90980400 | 41.15815500 |
| Lycoming County RMS Recycling Tower | Lycoming County | 447 ALEXANDER DR | BRADY | -76.92046300 | 41.14908600 |
| Lycoming County Prison Tower | Lycoming County | 277 W 3RD ST | WILLIAMSPORT | -77.00600200 | 41.23830700 |
| Lycoming County Tower Cemetery Hill & Cell Tower) | Lycoming County | 1180 CEMETERY HILL RD | CLINTON | -76.88735414 | 41.16015911 |
| Lycoming County Tower Waterville | Lycoming County | 2532 RAMSEY RD | CUMMINGS | -77.34369180 | 41.31659511 |
| Lycoming County North Mountain in Sullivan | Lycoming County | 1611 FOREST RD | DAVIDSON TWP | -76.55440195 | 41.31906300 |
| Lycoming County Tower Long Ridge | Lycoming County | 6030 LITTLE BEAR CREEK RD | PLUNKETTS CREEK | -76.77827544 | 41.33910374 |
| Cell Tower | NEXTEL | 620 JORDAN AVE | MONTOURSVILLE | -76.91926695 | 41.24703631 |

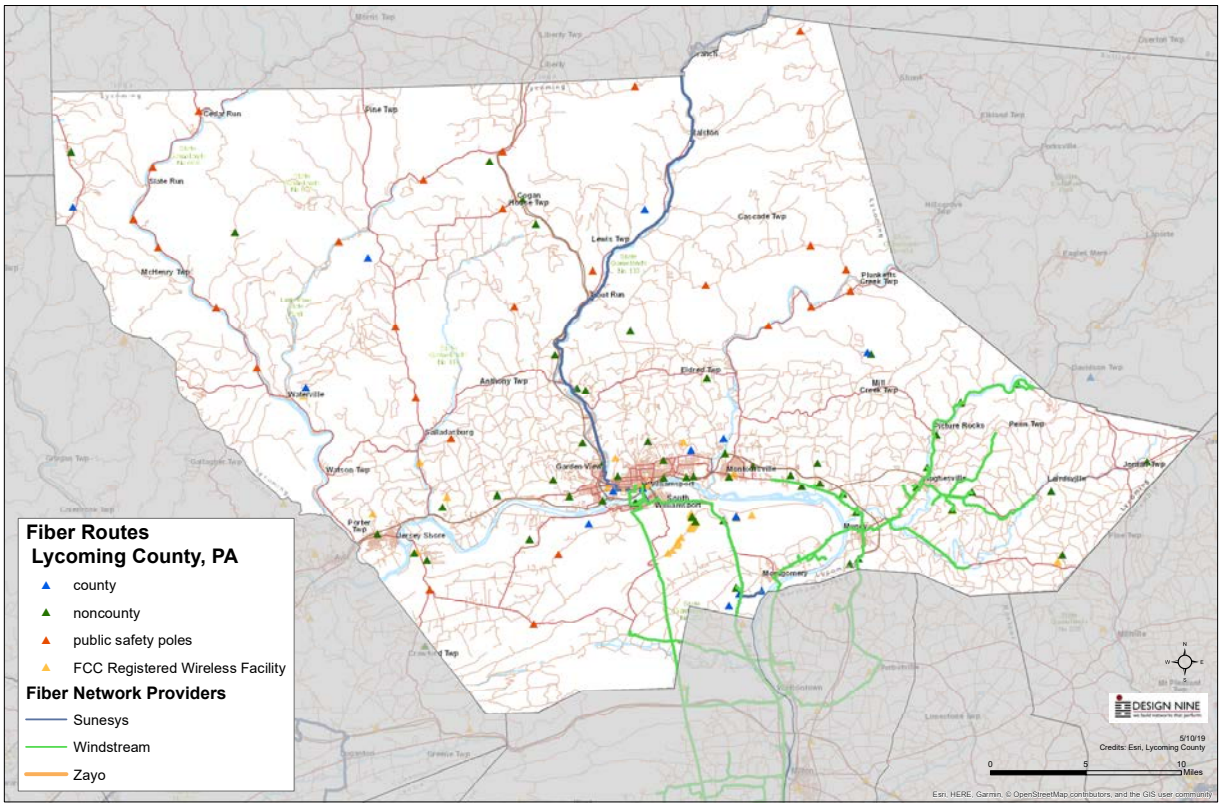
| | | | | | |
|---|---|---|---|---|---|
| Cell Tower | VZW - Cellco Partnership | 79 TOWER RD | MCHENRY | -77.41447602 | 41.43497159 |
| Cell Tower | Sprint & T-Mobile - SBA Properties | 384 MILL CREEK LN | MONTOURSVILLE | -76.92298990 | 41.26487588 |
| Cell Tower | VZW | 206 HOMER HOLLOW RD | COGAN HOUSE | -77.15741290 | 41.48730168 |
| Cell Tower | VZW / Nextel / IMMIX - Mt Union Telecom of PA | 3703 RT 15 HWY | CLINTON | -76.92505579 | 41.21368542 |
| Cell Tower | VZW / Sprint / Cingular - Vanguard Cellular PA | 211 ALLENWOOD CAMP LN | BRADY | -76.91298638 | 41.16275151 |
| Cell Tower | IMMIX - Mountain Union Telecom of PA | 170 RADER AVE | HEPBURN | -77.06254810 | 41.31319519 |
| Cell Tower | IMMIX / Sprint - Mountain Union Telecom of PA | 202 HIGH ST | JERSEY SHORE | -77.27273892 | 41.20511572 |
| Cell Tower | Sprint / Nextel - SBA Properties, Inc | 1200 DAUBER RD | LEWIS | -77.09291584 | 41.34023084 |
| Cell Tower | Spprint - SBA Properties, Inc | 1946 E 3RD ST | LOYALSOCK | -76.96203623 | 41.24719365 |
| Cell Tower | VZW - Cellco Partnership | 2457 RT 118 HWY | MORELAND | -76.67505968 | 41.23301299 |
| Cell Tower | VZW / Sprint / T-Mobile - SBA Properties, Inc | 400 CHRONISTER LN | MUNCY CREEK | -76.79874056 | 41.17967110 |
| Cell Tower | VZW / Cingular / Nextel - American Tower PA LLC | 353 YETTER RD | MUNCY TWP | -76.80488990 | 41.23325869 |
| Cell Tower | VZW - Cellco Partnership | 811 OLD FORT RD | NIPPENOSE | -77.23578965 | 41.19074989 |
| Cell Tower | Vanguard Cellular PA(was 374 Bunker Hill Rd) | 240 TURKEY TROT LN | NIPPENOSE | -77.22310003 | 41.18517999 |
| Cell Tower | Nextel - Spectrasite Communications, Inc. | 528 BUCKS RD | OLD LYCOMING | -77.06595491 | 41.27390783 |
| Cell Tower | Sprint / Nextel - SBA Properties, Inc | 675 MARTINS RD | PIATT | -77.20714897 | 41.22551910 |
| Cell Tower | IMMIX - Spectrasite Communications, Inc. | 157 BERTIN HTS | SUSQUEHANNA | -77.11996166 | 41.20050099 |
| Cell Tower | Sprint - SBA Properties, Inc | 263 SUNSET DR | WOODWARD | -77.15217288 | 41.23432539 |
| Cell Tower | Sprint / Nextel - Spectrasite Communications, Inc. | 3357 WAHOO DR | WILLIAMSPORT | -77.07970519 | 41.23298589 |
| Cell Tower | Sprint / Cingular - Vanguard Cellular PA | 100 ARCH ST | WILLIAMSPORT | -77.04621512 | 41.22985702 |
| Cell Tower | VZW - Cellco Partnership | 2519 SKYLINE DR | ARMSTRONG | -76.95332834 | 41.21296676 |
| Cell Tower | VZW & T-Mobile | 1010 COMMERCE PARK DR | WILLIAMSPORT | -76.98465084 | 41.24681035 |
| Cell Tower | Cingular | 1871 MOSTELLER RD | ELDRED | -76.94039936 | 41.32175644 |
| Cell Tower | IMMIX | 318 S RAILROAD ST | HUGHESVILLE | -76.73094154 | 41.23717609 |
| Cell Tower | CINGULAR - Vanguard Cellular Pennsylvania LLC | 297 COUDY PIKE TRL | BROWN | -77.57966857 | 41.49592837 |
| Cell Tower | Nextel | 2690 STEAM VALLEY RD | COGAN HOUSE | -77.12461940 | 41.45838466 |
| Cell Tower | VZW / Sprint / Cingular / T-Mobile -SBA Properties | 101 DIAMOND DR | HEPBURN | -77.07116946 | 41.31504181 |

| | | | | | |
|---|---|---|---|---|---|
| Cell Tower | Sprint | 2475 LYCOMING MALL DR | MUNCY TWP | -76.84617241 | 41.23892332 |
| Cell Tower | Cell Tower | 226 OWL HILL RD | PENN | -76.62748802 | 41.31468261 |
| Cell Tower | Cell Tower | 13192 RT 118 HWY | JORDAN | -76.49893261 | 41.25472297 |
| Cell Tower | Cell Tower | 9875 RT 220 HWY | SHREWSBURY | -76.68540746 | 41.30150261 |
| Cell Tower | VZW / CINGULAR / T-Mobile - Crown Castle | 1299 VALLAMONT DR NW | LOYALSOCK | -77.03104569 | 41.24833884 |
| Cell Tower | CINGULAR / SPRINT | 1534 BUCKHILL RD | MORELAND | -76.69520333 | 41.21980982 |
| Cell Tower | VZW / Sprint / Cingular - on roof of Genetti | 200 W 4TH ST | WILLIAMSPORT | -77.00540023 | 41.24088070 |
| Cell Tower | Nextel | 33 W 3RD ST | WILLIAMSPORT | -77.00188314 | 41.24020877 |
| Cell Tower | Cingular | 2495 E 3RD ST | LOYALSOCK | -76.95468149 | 41.24774673 |
| Cell Tower | Nextel | 307 FAIRFIELD RD | FAIRFIELD | -76.89500151 | 41.25459756 |
| Cell Tower | Nextel | 1100 GRAMPIAN BLVD | WILLIAMSPORT | -76.98472649 | 41.26018041 |
| Cell Tower | IMMIX | 300 LYCOMING MALL CIR | MUNCY TWP | -76.82762694 | 41.24125439 |
| Cell Tower | IMMIX | 1879 SKYLINE DR | ARMSTRONG | -76.95683499 | 41.21643107 |
| Cell Tower | Cell Tower | 381 RESERVOIR RD | WOLF | -76.71999371 | 41.25250547 |
| Cell Tower | VZW | 770 OXBOW LN | FRANKLIN | -76.59546130 | 41.23284947 |
| Cell Tower | T-Mobile | 123 INDUSTRIAL PKWY | MUNCY CREEK | -76.79192395 | 41.21858547 |
| Cell Tower | T-Mobile | 1002 W FRONT ST | S. WILLIAMSPORT | -77.00409553 | 41.23199133 |
| Cell Tower | American Towers | 281 SNYDER RD | FRANKLIN | -76.58531808 | 41.18450619 |
| Cell Tower | VZW | 276 CEMETERY RD | FAIRFIELD | -76.85718335 | 41.24782642 |
| FAA Tower Picture Rocks non-directional beacon | FAA | 63 ARROWHEAD CIR | PICTURE ROCKS | -76.71015998 | 41.27705071 |
| FAA Bldg/Tower Outer Marker | FAA | 672 LYCOMING MALL RD | MUNCY TWP | -76.83018618 | 41.25674218 |
| FAA VOR tower | FAA | 6038 LITTLE BEAR CREEK RD | PLUNKETTS CREEK | -76.77486944 | 41.33855175 |
| Cell Tower | VZW | 1743 W FRONT ST | S. WILLIAMSPORT | -77.01417639 | 41.22770060 |
| Radio Tower | Not Provided | 1643 W FRONT ST | S. WILLIAMSPORT | -77.01272311 | 41.22806429 |
| Cell Tower | AT&T | 2065 POCO FARM RD | LOYALSOCK | -77.00010383 | 41.27439934 |
| Communications Tower | Gas Company Seneca Resources | 1524 OAKS HUNTING CLUB LN | GAMBLE TWP | -77.01705533 | 41.35811205 |
| Cell Tower | Cingular & AT&T Mobility | 1197 EDWARDS RD | COGAN HOUSE | -77.11125850 | 41.43978369 |
| Cell Tower | Not Provided | 2018 MILL LN | OLD LYCOMING | -77.04681658 | 41.25689983 |
| Cell Tower | Verizon Wireless | 920 DAUGHERTYS RUN RD | OLD LYCOMING | -77.09587818 | 41.24617043 |

# 2.4 FIBER ROUTES IN THE COUNTY

Fiber route data is compiled from publicly available sources. Some telecom providers do not share their route data.

Most fiber routes, not only in the county but throughout the country have been designed as long haul point to point fiber routes between population centers. This means that even if a fiber cable passes down a rural road or a residential area, it has not been designed for residential or small business fiber to the premises.



## 2.5 SERVED, UNDERSERVED, AND UNSERVED AREAS

The areas on the map below have been identified using FCC (Federal Communications Commission) 477 data. Service providers, including incumbent telephone and cable companies, file a 477 report with the FCC to identify where their service is available and at what speed, using the FCC designations :

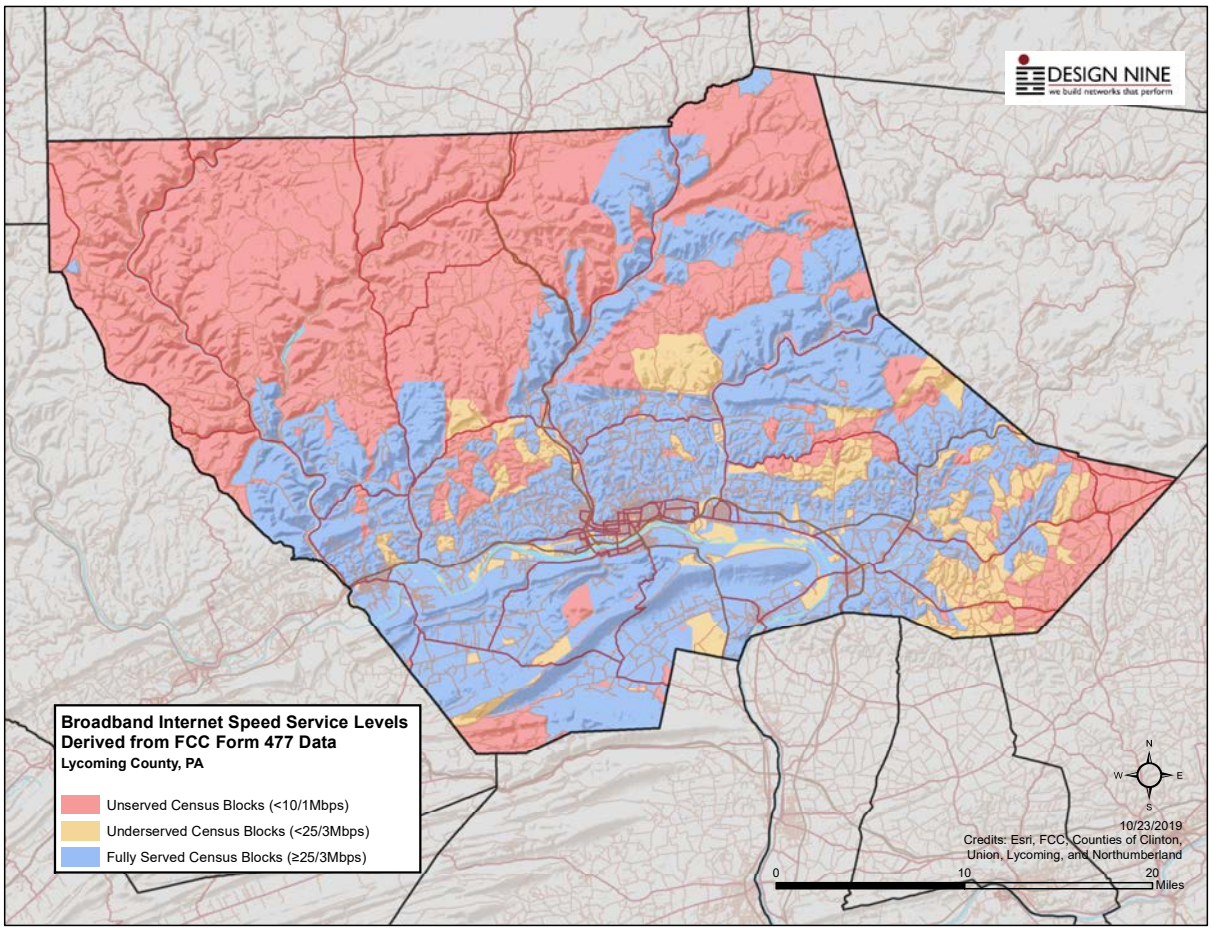
**Unserved** – Less than 10 Megabits down/1 Megabit up

**Underserved** – At least 10 Megabits down/1 Megabit up and less than 25 Megabits down/3 Megabits up

**Served** – Equal to or better than 25 Megabits down/3 Megabits up

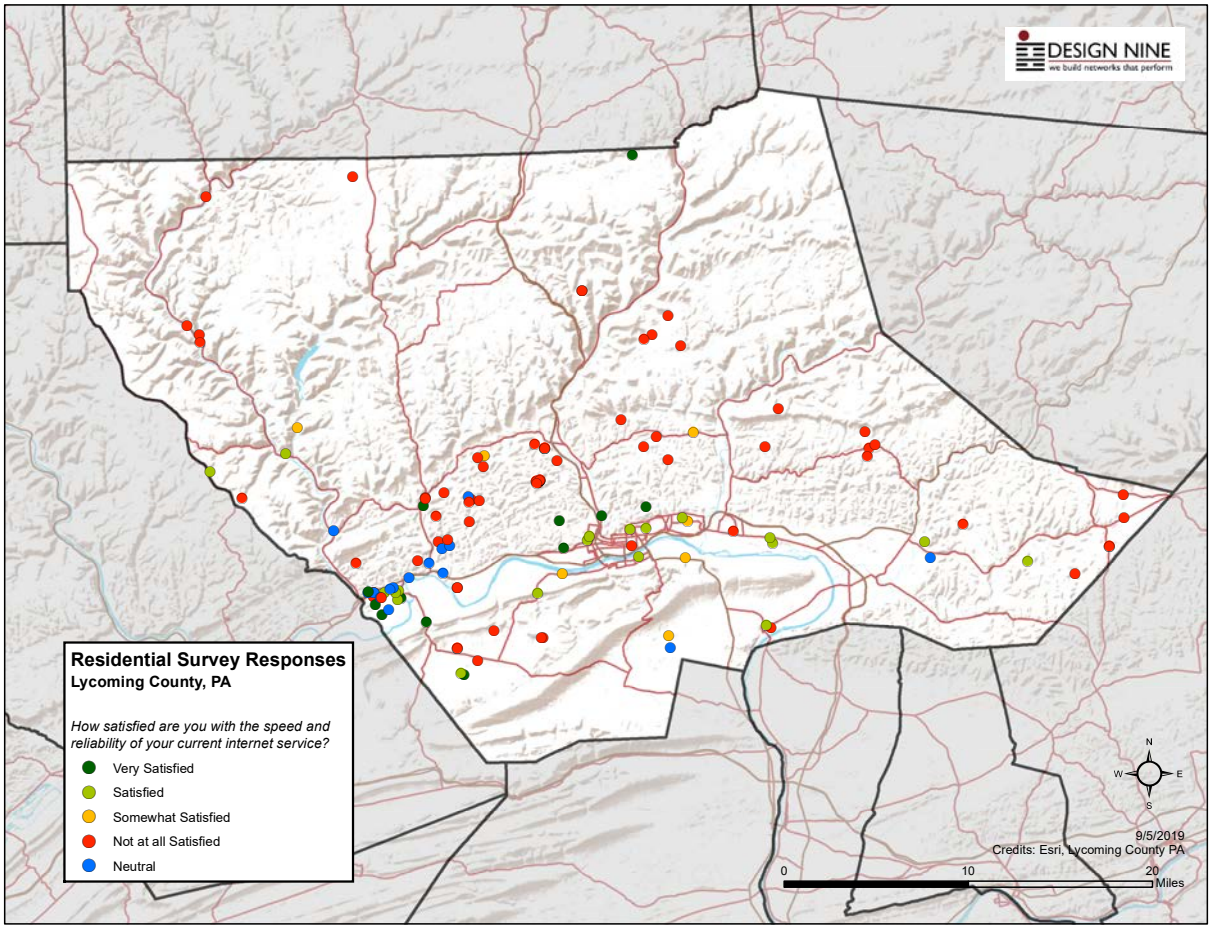
There are two problems with the 477 data:

- The data is self-reported by the providers, who typically report their most optimistic Internet speeds. In practice, customers may not always get the reported speeds.
- A single customer receiving service in a census block means that the provider can indicate that the entire census block is counted. So if one household receives 25/3 service, all households in that census block are counted as receiving that level of service.



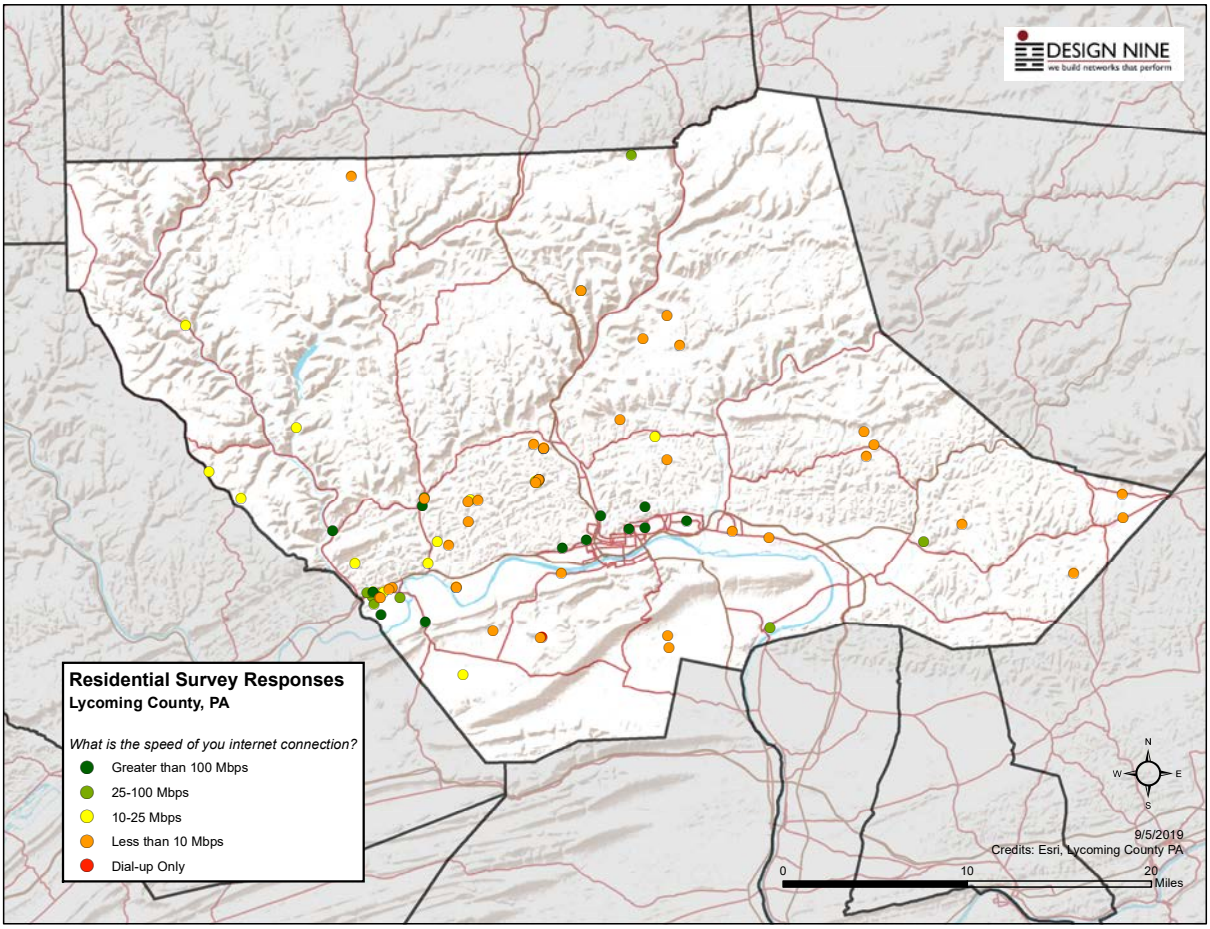
## 2.6 RESIDENTIAL SERVICE SATISFACTION FROM SURVEY DATA

The data plotted on the map below are the residential responses collected from the survey conducted as part of the broadband study. A large percentage of respondents are not at all satisfied with their current Internet service.



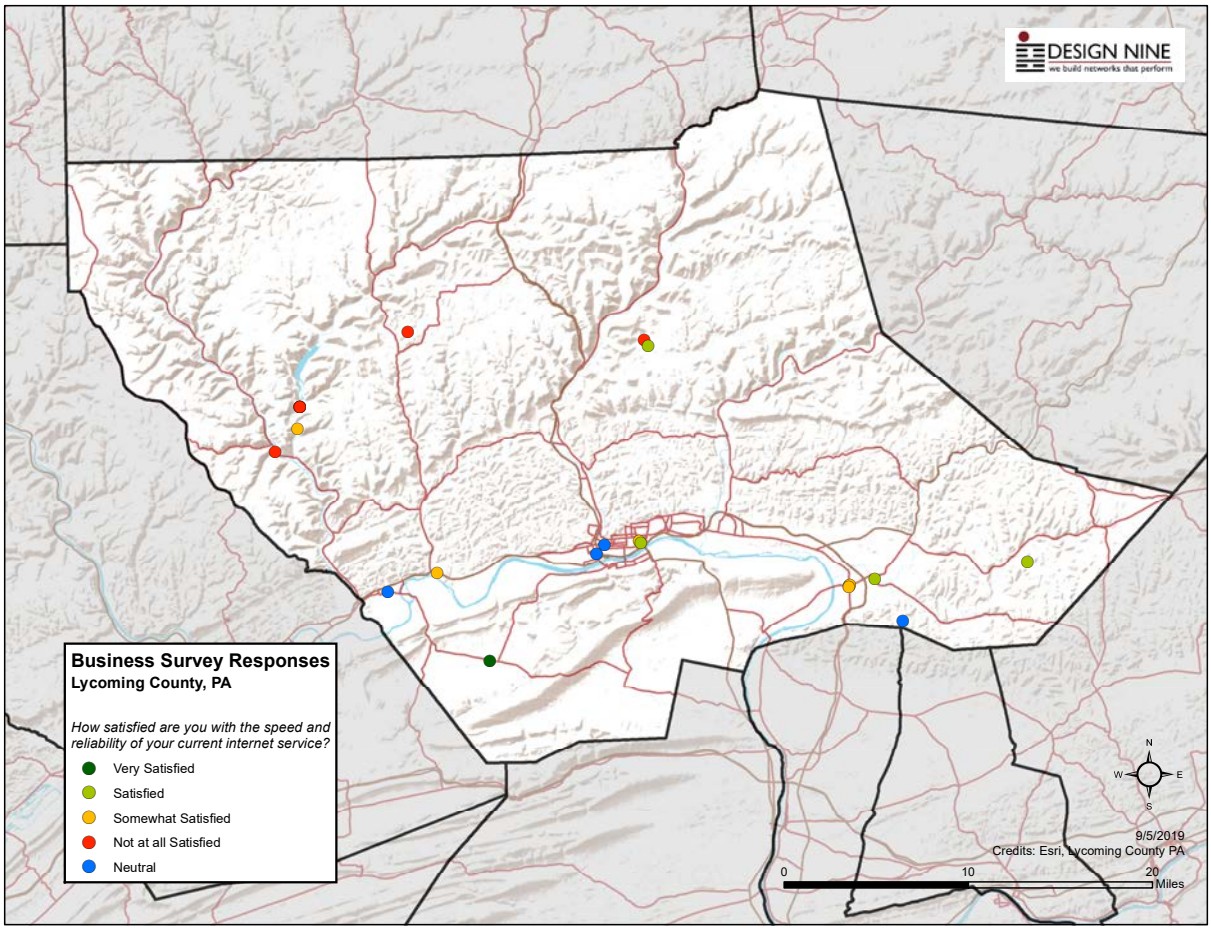
## 2.7 RESIDENTIAL INTERNET SPEED FROM SURVEY DATA

The data plotted on the map below are the residential responses collected from the survey conducted as part of the broadband study. A large percentage of respondents have reported speeds less than 10 Megabits down, or in the FCC classification, "unserved."



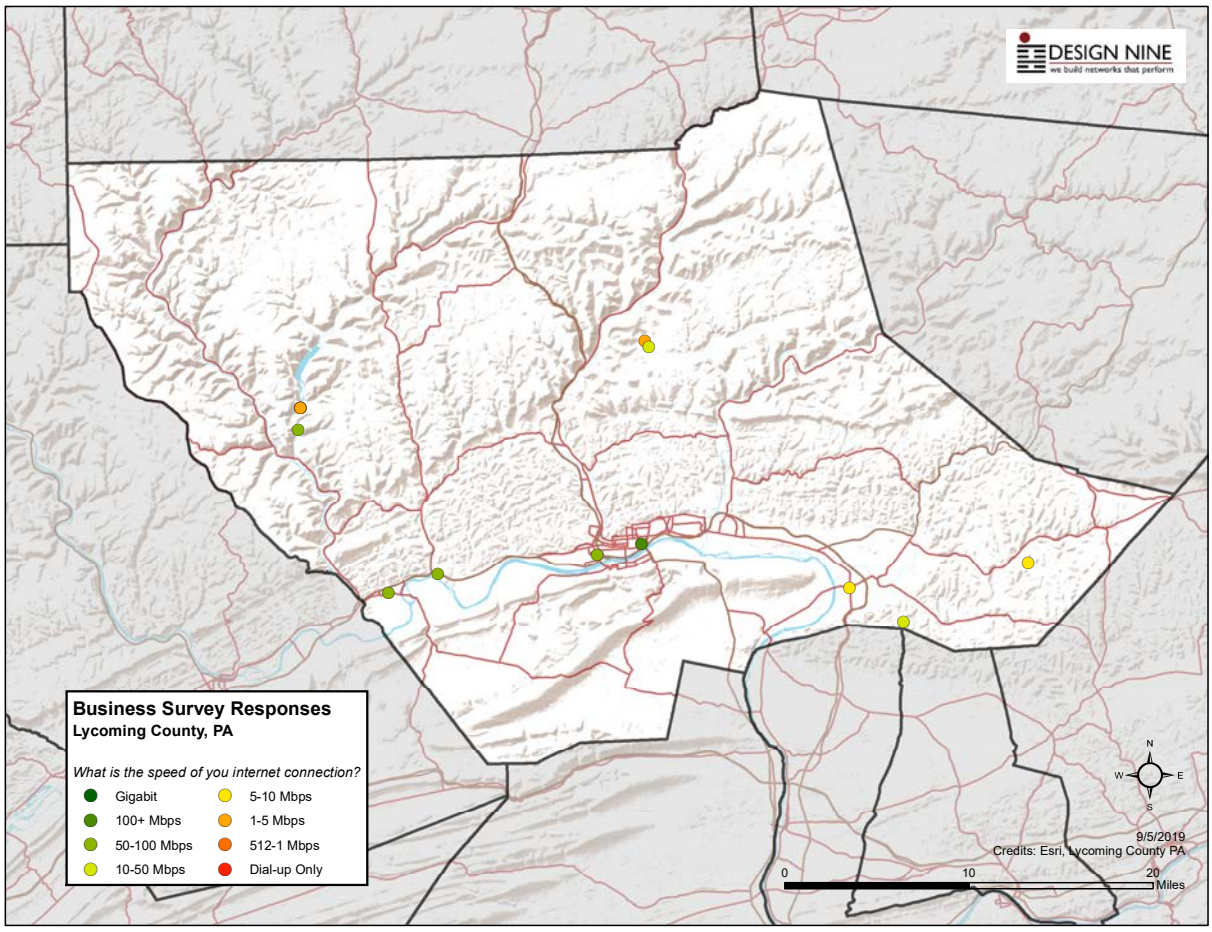
## 2.8 BUSINESS SERVICE SATISFACTION FROM SURVEY DATA

The data plotted on the map below are the business responses collected from the survey conducted as part of the broadband study. A mix of responses were received.



## 2.9 BUSINESS INTERNET SPEED FROM SURVEY DATA

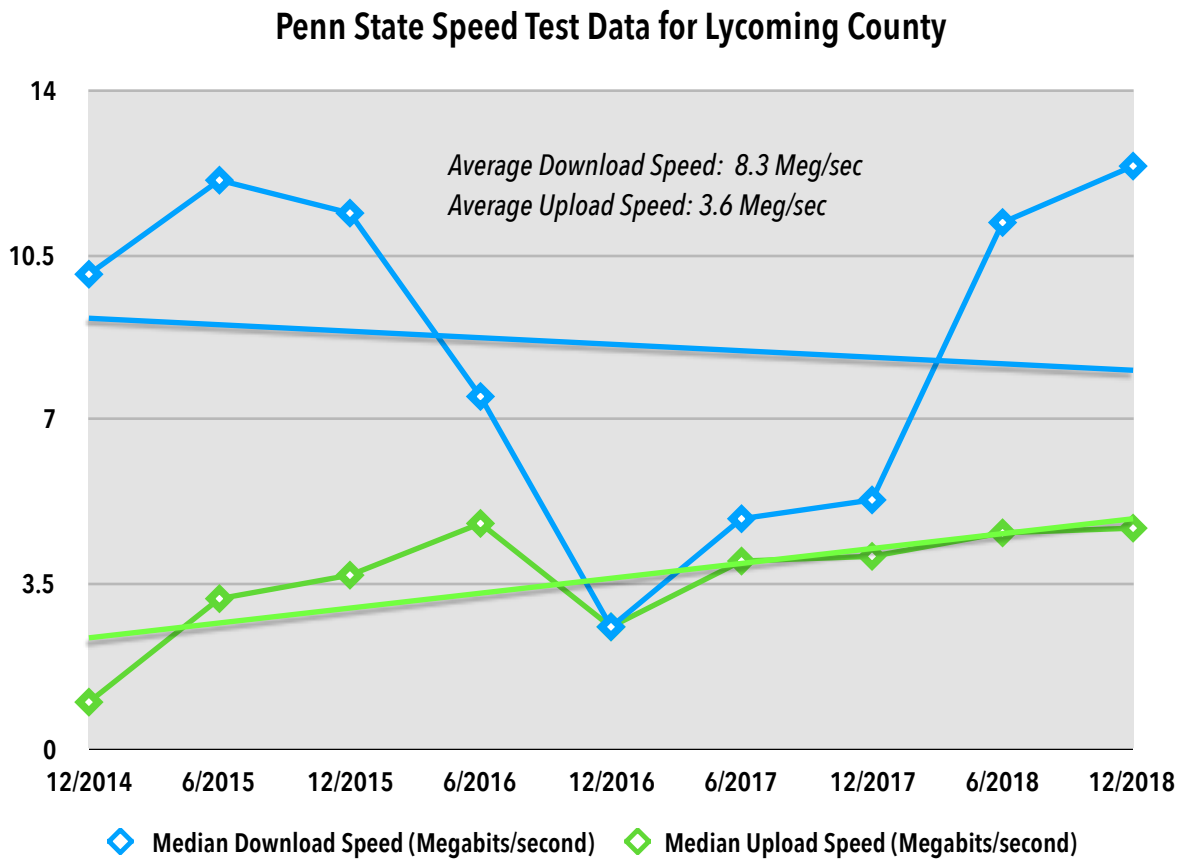
The data plotted on the map below are the business responses collected from the survey conducted as part of the broadband study. Most businesses have speeds of 10 Megabits or better.



## 2.10 PENN STATE SPEED TEST DATA

A Penn State research project has collected speed test data submitted by Pennsylvania residents and businesses for several years. The chart below shows the median upload and download speeds (Megabits/second).

Download speeds have been increasing in the past two years, and upload speeds have been increasing slightly. The average upload speed of 8.3 Megabits/second does not meet the FCC definition of underserved (minimum 10 Megabits/second). Using this data, the entire county is unserved or underserved.



# 3 LYCOMING COUNTY SERVICE PROVIDER ANALYSIS

This section of the report provides key insights into the services currently available in Lycoming county. It also provides data that show which areas by zip code are most impacted by poor Internet service and/or the lack of Internet Service provider options.

Four of the zip code areas no access to fixed wireless Internet Service Providers. Six of the zip codes have 0% of the homes meeting the 25 Mbps standard. One of the zip code areas has only 15% access to cable services. Very few of your residents have real choice in broadband providers.

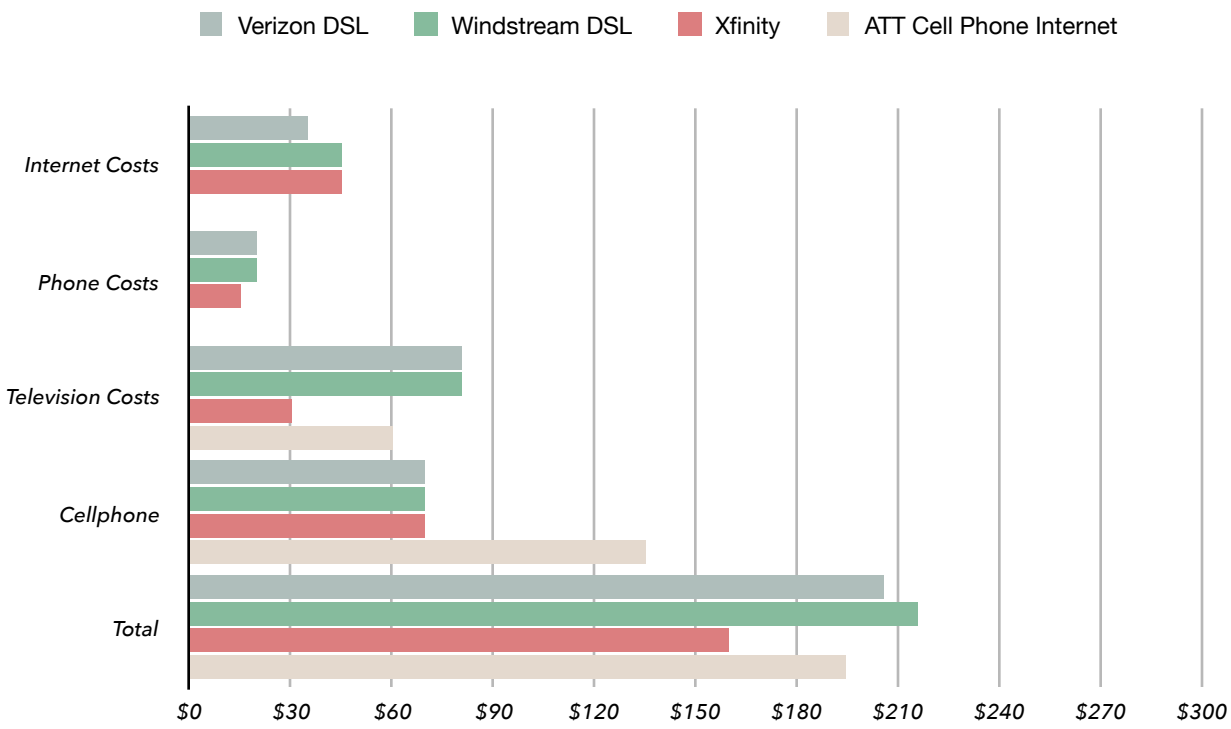
The average household in the United States pays $67 per month for Internet in their home. Usually rural areas either pay more and/or get a lot less for their money. Smartphones have become what can be an expensive substitute for reasonably priced Internet services. A single smartphone with an unlimited data plan can cost up to $135 per month with significant limitations on speeds after 22 GBs of data. Even "unlimited data" has limitations after a certain amount of data has been used.

Unfortunately averages can be misleading for specific areas of the county. Using the best available data we have constructed graphs showing sample communication costs for families receiving the Internet in different ways in Lycoming County. The only DSL offering advertised speeds better than 25 Mbps comes from Windstream but its availability is spotty except in four zip codes. Verizon DSL is almost as expensive but does not come close to 25 Mbps. Xfinity cable services actually show up as the least expensive services meeting 25 Mbps. However, past experience has shown that the low rate will go up significantly in the second year. Most cable services go up year after year. Even assuming they were happy with the speed and choice on the lowest priced services we found, your typical Lycoming County family would spend $1920.00 annually for Internet, TV, phone, and cellphone. That price would likely be well over $2,000 in the second year.

**Lycoming County, PA Population 2010 by Zip Code- Population Data from US Census Zip Code**

| Zip/ ZCTA | USPS Town | % Households in the County | DSL | Cable | Fixed Wireless | 25 Mbps Coverage | 2010 Pop. | Land-Sq-Mi | Density Per Sq Mi |
|---|---|---|---|---|---|---|---|---|---|
| 17701 | Williamsport | 99.9% | 95% | 97% | 95.9% | 25% | 44,661 | 89.44 | 499.32 |
| 17702 | Williamsport | 100% | 98% | 99% | 87.7% | 99% | 10,721 | 61.89 | 173.22 |
| 17705 | Williamsport | 100% | 97.5% | 99% | 94.3% | 99% | No data | No data | No data |
| 17723 | Camal | 100% | 100% | 0% | 0% | 0% | 34 | 13.24 | 2.57 |
| 17727 | Cedar Run | 100% | 15% | 0% | 0% | 0% | 2,327 | 160.05 | 14.54 |
| 17728 | Westport | 100% | 98% | 43% | 77.6% | 44% | 102 | 87.30 | 1.17 |
| 17737 | Hughesville | 99.7% | 98% | 85% | 77.9% | 85% | 6,220 | 72.06 | 86.32 |
| 17740 | Jersey Shore | 84.8% | 97% | 91% | 73% | 91% | 12,754 | 136.19 | 93.65 |

| Zip/ ZCTA | USPS Town | % Households in the County | DSL | Cable | Fixed Wireless | 25 Mbps Coverage | 2010 Pop. | Land-Sq-Mi | Density Per Sq Mi |
|---|---|---|---|---|---|---|---|---|---|
| 17742 | Lairdsville | 100% | 82% | 0% | 0% | 0% | 39 | 0.08 | 513.16 |
| 17744 | Linden | 100% | 81% | 86% | 84.1% | 86% | 3,175 | 23.93 | 132.66 |
| 17752 | Montgomery | 100% | 98% | 98% | 76.9% | 98% | 4,635 | 35.41 | 130.89 |
| 17754 | Montoursville | 100% | 96% | 78% | 91.3% | 78% | 12,233 | 60.13 | 203.44 |
| 17756 | Muncy | 87.5% | 96% | 74% | 77.2% | 74% | 12,408 | 112.43 | 110.36 |
| 17771 | Trout Run | 100% | 100% | 28.5% | 0% | 28.5% | 3,158 | 215.79 | 14.63 |
| 17774 | Unityville | 98.7% | 98% | 0% | 0% | 0% | 1,277 | 47.67 | 26.79 |
| 17776 | Waterville | 100% | 90.2% | 55.9% | 0% | 55.9% | 295 | 87.52 | 3.37 |
| 17810 | Allenwood | 59.7% | 46.6% | 41% | 0% | 41% | 4,683 | 56.75 | 82.52 |



Internet Service Providers-1

| Zip Code | USPS Town | Frontier DSL | Penn Tel. Co. DSL | Verizon DSL | Windstream DSL | Xfinity Cable | Zito Cable | limitless mobile wireless | RiverValley Internet |
|---|---|---|---|---|---|---|---|---|---|
| 17701 | Williamsport | | | 95.1% | 2.4% | 97.2% | 4.2% | 95.9% | |
| 17702 | Williamsport | | 12.3% | 84.9% | | 99% | | 87.7% | |
| 17705 | Williamsport | | 2.4% | 93.2% | 2.2% | 97.5% | 3.4% | 94.3% | |
| 17723 | Camal | | | 100% | | | | | |
| 17727 | Cedar Run | 5.6% | | 9.7% | | | | | |
| 17728 | Westport | | | 98.1% | | 44.4% | 65.7% | 77.6% | |
| 17737 | Hughesville | | | | 98.9% | 85.8% | | 77.9% | |
| 17740 | Jersey Shore | | 16.3% | 83.7% | | 94.4% | | 66.9% | 6.80% |
| 17742 | Lairdsville | | | | 100% | | | | |
| 17744 | Linden | | | 81.3% | | 86.9% | | 84.1% | |
| 17752 | Montgomery | | | 4% | 99.3% | 99.1% | | 76.9% | |
| 17754 | Montoursville | | | 95.4% | 7.7% | 81.3% | 25.4% | 91.3% | |
| 17756 | Muncy | | | 13.2% | 91.1% | 74.1% | | 77.2% | |
| 17771 | Trout Run | | | 93.8% | | | 28.5% | | |
| 17774 | Unityville | 14.3% | | 65% | 18.8% | | | | |
| 17776 | Waterville | | | 90.2% | | 55.9% | | | |
| 17810 | Allenwood | | | 46.6% | | 41% | | | |

## 3.1 WIRELINE PROVIDERS

This information provides pricing data and services available from providers in Lycoming County.

### FRONTIER DSL

$20/mo for 6 Mbps↓ – Mbps ↑ w/no data cap -Simply Broadband Core, 2 year promo rate, Setup $75. Modem $10/month.

$25/mo for 12 Mbps↓ – Mbps ↑ w/no data cap -Simply Broadband Ultra, 2 year promo rate, Setup $75. Delivery/handling fee $9.99. Modem $10/month.

$30/mo for 18 Mbps↓ – Mbps ↑ w/no data cap -Simply Broadband Ultra, 2 year promo rate, Setup $75. Delivery/handling fee $9.99. Modem $10/month. Verizon  DSL

$34.99/mo for 0.5 to 15 Mbps ↓ – Mbps ↑ High Speed Internet. Verizon home phone service required. Activation fee waived online.  Modem w/WiFi $29.99 one-time purchase.

$54.99/mo for 0.5 to 15 Mbps ↓ – Mbps ↑ High Speed Internet Enhanced + Freedom Verizon home phone service required. Activation fee waived online.  Modem w/WiFi $29.99 one-time purchase.

### PENNSYLVANIA TELEPHONE COMPANY DSL

$29.77/mo for 1 Mbps↓ – 0.256 Mbps ↑ Setup $142.50. Modem $34.95 one time purchase.

$39.95/mo for 5 Mbps↓ – 1.0 Mbps ↑ Setup $142.50. Modem $34.95 one time purchase.

$49.95/mo for 10 Mbps↓ – 1.0 Mbps ↑ Setup $142.50. Modem $34.95 one time purchase.

### VERIZON DSL

$34.99/mo for 0.5 to 15 Mbps ↓ – Mbps ↑ High Speed Internet. Verizon home phone service required. Activation fee waived online.  Modem w/WiFi $29.99 one-time purchase.

$54.99/mo for 0.5 to 15 Mbps ↓ – Mbps ↑ High Speed Internet Enhanced + Freedom Verizon home phone service required. Activation fee waived online.  Modem w/WiFi $29.99 one-time purchase.

### WINDSTREAM DSL

$36/mo for 25 Mbps↓ – Mbps ↑  No additional information available

### XFINITY CABLE

$89.99 /mo for 150 Mbps Standard Triple Play: Internet + Limited Basic TV + Xfinity Voice Unlimited

$99.99 /mo for 150 Mbps Standard Triple Play: Internet + Limited Basic + Digital Preferred TV + Xfinity Voice Unlimited

$119.99 /mo for 400 Mbps Signature Triple Play: Internet + Limited Basic + Digital Preferred TV + Xfinity Voice Unlimited

$149.99 /mo for 1,000 Mbps Super Triple Play: Internet + Limited Basic + Digital Preferred TV + Xfinity Voice Unlimited

$64.99 /mo for 150 Mbps Standard Double Play: Internet + Limited Basic TV

$79.99 /mo for 150 Mbps Standard Double Play: Internet + Limited Basic + Digital Preferred TV

$99.99 /mo for 150 Mbps Standard Double Play: Internet + Limited Basic + Digital Preferred TV

$129.99 /mo for 250 Mbps Super Double Play: Internet + Limited Basic + Digital Preferred TV

$34.99 /mo for 60 Mbps Performance Internet

$79.99 /mo for 400 Mbps Extreme Pro Internet

$89.95 /mo for 150 Mbps Performance Pro Internet

$89.99 /mo for 1,000 Mbps Gigabit Internet

$94.95 /mo for 250 Mbps Blast® Internet

### ZITO CABLE

$39.95 /mo for 50 Mbps↓ – Mbps ↑ Super-Speed Internet and Voice w/ a 500 GB/monthly data cap. 2-year promo rate. Contract term 2 years. Bundled with VoIP home phone. Setup $0 (free standard installation)

$49.95 /mo for 100 Mbps↓ – Mbps ↑Ultra-Speed Internet and Voice w/ a 750 GB/monthly data cap. 2-year promo rate. Contract term 2 years. Bundled with VoIP home phone. Setup $0 (free standard installation)

$49.95 /mo for 200 Mbps↓ – Mbps ↑Mega-Speed Internet and Voice w/ a 3,000 GB/monthly data cap. 2-year promo rate. Contract term 2 years. Bundled with VoIP home phone. Setup $0 (free standard installation)

## 3.2 WIRELESS INTERNET SERVICE PROVIDERS

### Limitless Mobile

$29.99/mo for 5 Mbps ↓ – Mbps ↑ Best Value Internet

$39.99/mo for 10 Mbps ↓ – Mbps ↑ Fast Ultra Internet

### RiverValley

$40/mo for 5 Mbps ↓ – Mbps ↑ Mini Internet

$50/mo for 10 Mbps ↓ – Mbps ↑ Surfer Plus Internet

$70/mo for 20 Mbps ↓ – Mbps ↑ Media Internet

$90/mo for 35 Mbps ↓ – Mbps ↑ Turbo Internet

### getwireless.net

No plan information available

## 3.3 SATELLITE INTERNET SERVICE PROVIDERS

### HUGHESNET

$59.99/mo for 25 Mbps ↓ 3 Mbps ↑ 10 GB/mo data cap. Two year contract with up to $400 ETF. Two year prom rate. Speeds will be reduced and will typically be in the range of 1 to 3 Mbps once monthly plan data is use. From 2am-8am, customers have access to 50 GB/month of additional plan data. Setup $99. Modem: $14.99/mo.

$69.99/mo for 25 Mbps ↓ 3 Mbps ↑ 20 GB/mo data cap. Two year contract with up to $400 ETF. Two year promo rate. Speeds will be reduced and will typically be in the range of 1 to 3 Mbps once monthly plan data is use. From 2am-8am, customers have access to 50 GB/month of additional plan data. Setup $99. Modem: $14.99/mo.

$99.99/mo for 25 Mbps ↓ 3 Mbps ↑ 30 GB/mo data cap. Two year contract with up to $400 ETF. Two year promo rate. Speeds will be reduced and will typically be in the range of 1 to 3 Mbps once monthly plan data is use. From 2am-8am, customers have access to 50 GB/month of additional plan data. Setup $99. Modem: $14.99/mo.

$149.99/mo for 25 Mbps ↓ 3 Mbps ↑ 50 GB/mo data cap. Two year contract with up to $400 ETF. Two year promo rate. Speeds will be reduced and will typically be in the range of 1 to 3 Mbps once monthly plan data is use. From 2am-8am, customers have access to 50 GB/month of additional plan data. Setup $99. Modem: $14.99/mo.

### VIASAT/EXEDE

$50/mo for up to 12 Mbps ↓ with 12 GB data cap. Contract term two years. Once Priority Data is used up, speeds will be reduced to up to 1 to 5 Mbps during the day and possibly below 1 Mbps after 5 pm. Free zone from 3 am to 6 am daily. Setup with free standard installation $0. Modem w/WiFi $10 per mon

$75/mo for 12 Mbps ↓ with 25 GB data cap. Contract term two years. Once Priority Data is used up, speeds will be reduced to up to 1 to 5 Mbps during the day and possibly below 1 Mbps after 5 pm. Free zone from 3 am to 6 am daily. Setup with free standard installation $0. Modem w/WiFi $10 per mon

$100/mo for 12 Mbps ↓ with 50 GB data cap. Contract term two years. Once Priority Data is used up, speeds will be reduced to up to 1 to 5 Mbps during the day and possibly below 1 Mbps after 5 pm. Free zone from 3 am to 6 am daily. Setup with free standard installation $0. Modem w/WiFi $10 per month

$150/mo for 25 Mbps ↓ with no data cap. Contract term two years. After 100 GB of data usage, your data may be prioritized behind other customers during network congestion. Setup with free standard installation $0. Modem w/WiFi $10 per month

| Key Area Sites | Estimated Cost of Fixed Point Wireless | Estimated Route Miles in Unserved/ Underserved Areas for Fiber to the Home | Cost of Fiber to the Home (Low Estimate at $110,000/mile) | Cost of Fiber to the Home (High Estimate at $135,000/mile) |
|---|---|---|---|---|
| Key Area 1 - Anthony Township Tower | $205,168 | | | |
| Key Area 1 - Gamble Township Tower | $205,168 | | | |
| Sub-total | $410,335 | 49.6 | $5,453,250 | $6,692,625 |
| Key Area 2 - Long Ridge Tower | $39,288 | 20.6 | $2,260,500 | $2,774,250 |
| Key Area 3 - Moreland Township Tower | $205,168 | 58.4 | $6,426,750 | $7,887,375 |
| Grand Total | **$654,790** | | **$14,140,500** | **$17,354,250** |

# 4 LYCOMING KEY AREA PROJECTS

Three key areas in the county were selected for projects that could potentially be funded from grants and other funding sources. There are two maps on the next two pages showing key details:

Map one shows the underserved and unserved areas of the county with the three Key Area projects overlaid. Although the county has very large areas that are completely underserved, the household density is very low. The key areas were selected to focus on underserved areas with higher household density than many of the unserved areas.

Map two shows the key area projects with the estimated wireless propagation—that is, the shaded areas indicate where households and businesses are likely to receive service. The propagation analysis software takes into account terrain and tree cover. However, for best service, a clear line of sight between the customer premises and the tower will produce the strongest signal and the highest speed service. The newer LTE radios now being deployed by many service providers will provide some service through light tree cover (near line of sight).

All sites have been analyzed using line of sight software to predict the availability of line of sight between the towers, which would allow the creation of an area-wide network. This will make the three key area projects more attractive to WISPs (Wireless Internet Service Providers), who can offer service via the four towers as a single contiguous network.

The tables in this section describe the cost of constructing or improving towers to expand broadband access in the area. When a tower exists there will still be costs necessary to get it ready for a WISP to use, we typically refer to this as tower "Fit-up". Where a new tower is required the costs will include the construction of the tower and higher costs for items such as road improvements and power service installation.

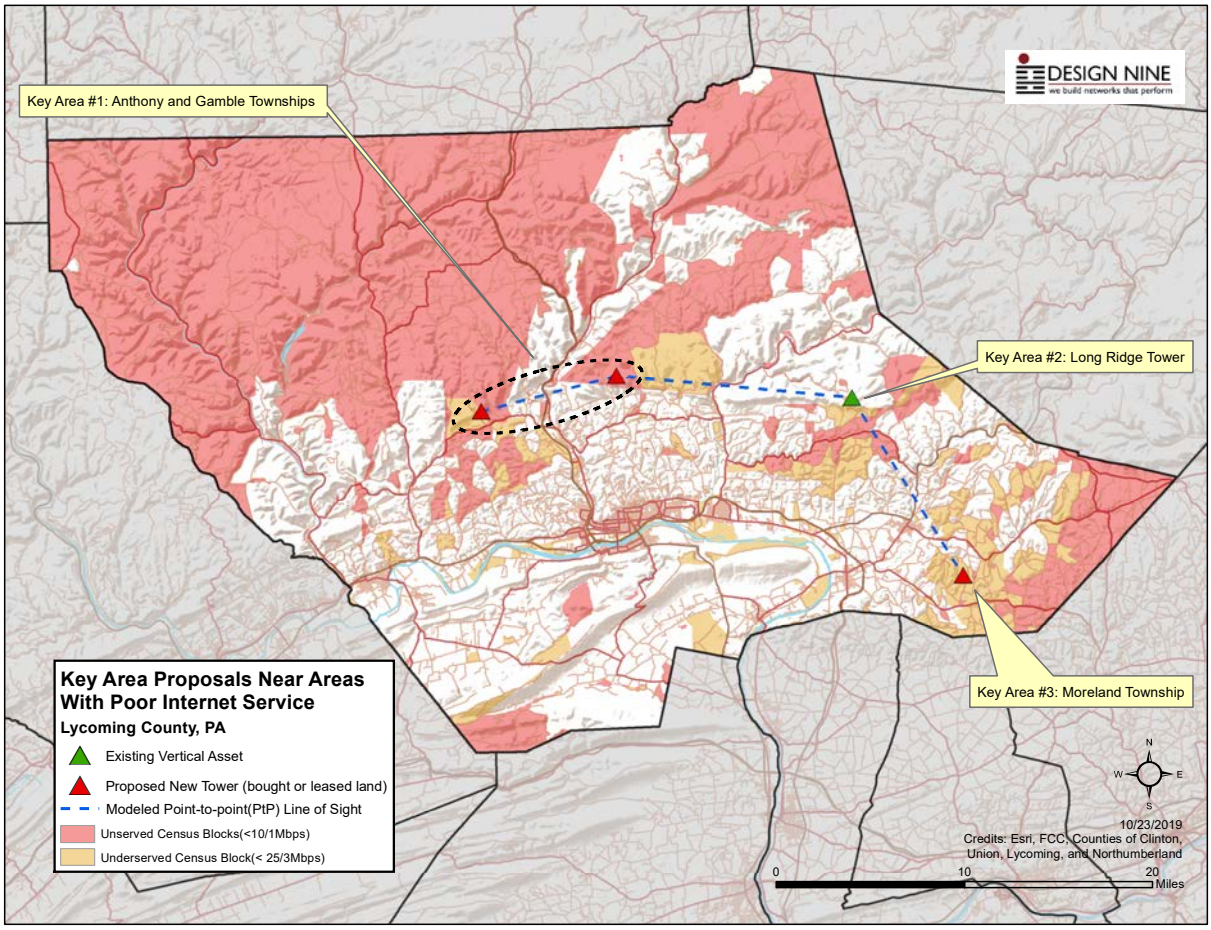
There is a contingency in the estimate for each tower, and we have included $15,000 in each estimate where it is known the tower will be on private property. If the project does require leasing on private property it is often best to get a long term lease with the lease payments made up front. *I.E., $1,500 per year for 10 years, paid in full up front*.

The table below provides a summary of the three Key Area fixed point wireless projects and a comparison of the cost of placing underground fiber in the same underserved/unserved areas. The fiber estimate costs include all of the fiber and conduit materials, handholes, and network equipment, including customer premises equipment (CPE). A more detailed analysis of the fiber option is likely to identify some less expensive options, including some areas where less expensive aerial fiber could be deployed, and some routes where household density is low may remain limited to wireless broadband access.

***It is important to note that any tower improvements or new tower sites should be reviewed with local WISPs before committing funds. If possible, obtain an agreement from a WISP to use the tower to offer services prior to making improvements or constructing a new tower.***

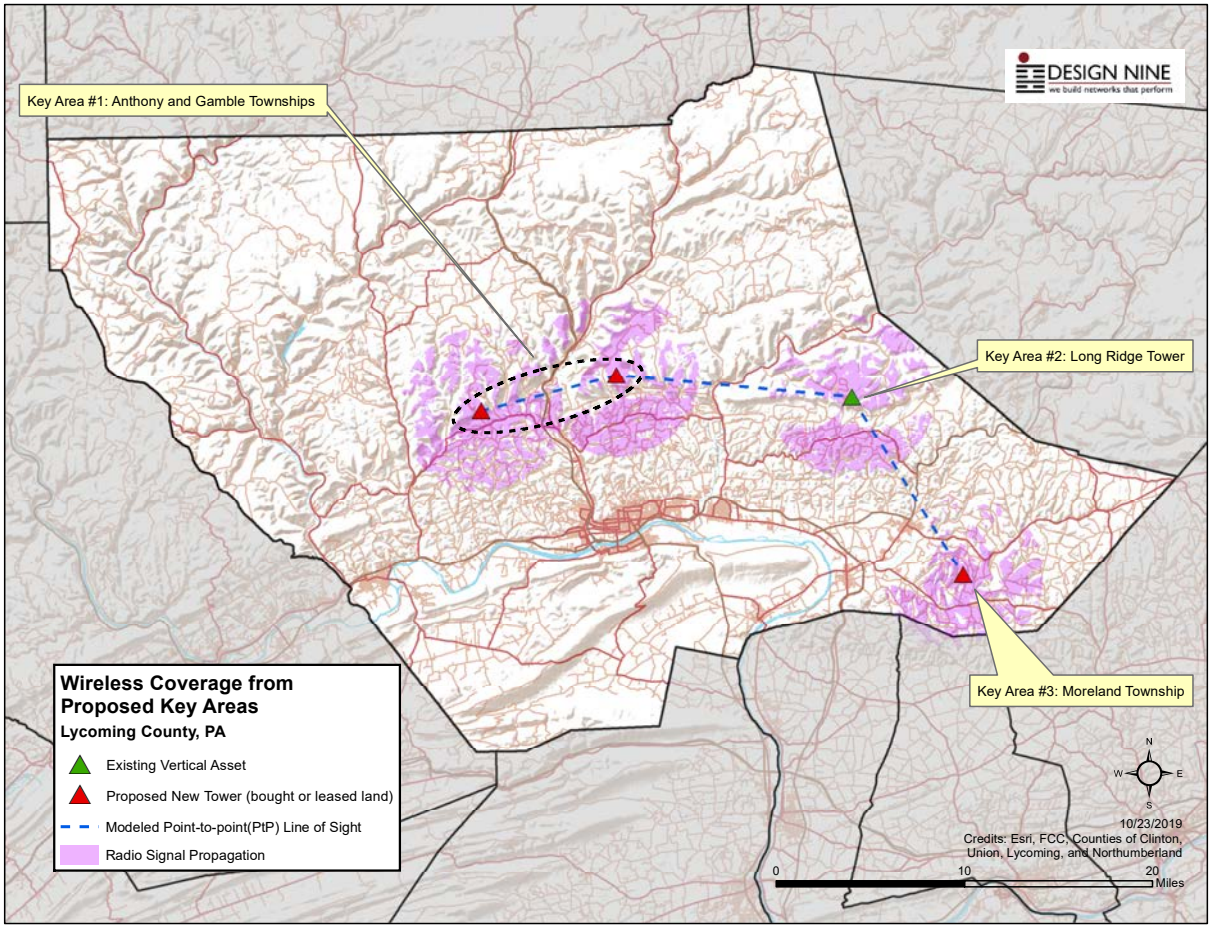
## Map One: Network Design

This map shows the unserved and underserved areas in the county and the location of four towers proposed in three key areas. Three of the towers are new construction, and one tower on Long Ridge is existing and could be used with modest improvements.



## Map Two: Propagation Analysis

The shaded areas show the likely coverage that will be obtained from the towers. Line of sight or near line of sight between the tower and a wireless customer is required. Heavy tree cover may diminish the signal (less speed) or block the signal entirely.



# 4.1 KEY AREA ONE: ANTHONY AND GAMBLE

Key Area One includes two new towers.

## Gamble Township Tower

| ITEM/PROJECT | UNITS | UNIT COST LOW | UNIT COST HIGH | TOTAL (AVG) |
|---|---|---|---|---|
| Tower Fit-up Activities: $0.00 | | | | |
| Tower Study / Mapping / Load Analysis | 0 | $4,500.00 | $7,000.00 | $0.00 |
| Site Development (road repairs and general maintenance) | 0 | $0.00 | $1,500.00 | $0.00 |
| Fit-up: New Power Service / Installation<br>Assumes power available on site, new meter placement required to support WISP equipment | 0 | $1,250.00 | $2,500.00 | $0.00 |
| Labor and Contracting: $82,640.00 | | | | |
| New: Site Development (Clearing, Road Improvements, etc.) | 1 | $10,000.00 | $20,000.00 | $15,000.00 |
| New Site: New Power Service / Installation | 1 | $1,250.00 | $3,450.00 | $2,350.00 |
| 180' Guyed Tower Construction Labor & Contracting | 1 | $50,000.00 | $74,750.00 | $62,375.00 |
| Cabinet Installation Labor | 1 | $600.00 | $1,150.00 | $875.00 |
| Power System Installation Labor | 1 | $300.00 | $575.00 | $437.50 |
| Generator Installation Labor | 1 | $1,250.00 | $1,955.00 | $1,602.50 |
| Propane Service Installation<br>Tank furnished and installed by local gas provider | 1 | $750.00 | $1,250.00 | $1,000.00 |
| Materials: $36,585.00 | | | | |
| 180' Guyed Tower Construction Materials | 1 | $17,500.00 | $27,500.00 | $22,500.00 |
| Small Telecom Cabinet<br>AMPROD AM47P-2636-24RU OR EQUIVALENT, ALUMINUM CABINET - FRONT AND REAR DOORS- HVAC/HEAT - ADJUSTABLE RACK RAILS 19" | 1 | $6,000.00 | $7,500.00 | $6,750.00 |
| Cabinet Foundation and Installation Materials | 1 | $1,000.00 | $1,500.00 | $1,250.00 |
| 10kW Liquid Propane Generator | 1 | $4,000.00 | $6,000.00 | $5,000.00 |
| Battery backup system | 1 | $905.00 | $1,265.00 | $1,085.00 |
| Total: | | | | $120,225.00 |
| Project Management, Network Engineering, Testing | | | | $38,420.00 |
| Site Engineering, Surveying, Viewshed Analysis, Etc. | | | | $9,500.00 |
| Misc Fees, Technical Services | | | | $7,500.00 |
| Site Acquisition, Land Lease | | | | $17,500.00 |
| Contingency | | | | $12,022.50 |
| TOTAL: | | | | $205,167.50 |

## Anthony Township Tower

| ITEM/PROJECT | UNITS | UNIT COST LOW | UNIT COST HIGH | TOTAL (AVG) |
|---|---|---|---|---|
| Tower Fit-up Activities: $0 | | | | |
| Tower Study / Mapping / Load Analysis | 0 | $4,500 | $7,000 | $0 |
| Site Development (road repairs and general maintenance) | 0 | $0 | $1,500 | $0 |
| Fit-up: New Power Service / Installation<br>Assumes power available on site, new meter placement required to support WISP equipment | 0 | $1,250 | $2,500 | $0 |
| Labor and Contracting: $82,640 | | | | |
| New: Site Development (Clearing, Road Improvements, etc.) | 1 | $10,000 | $20,000 | $15,000 |
| New Site: New Power Service / Installation | 1 | $1,250 | $3,450 | $2,350 |
| 180' Guyed Tower Construction Labor & Contracting | 1 | $50,000 | $74,750 | $62,375 |
| Cabinet Installation Labor | 1 | $600 | $1,150 | $875 |
| Power System Installation Labor | 1 | $300 | $575 | $438 |
| Generator Installation Labor | 1 | $1,250 | $1,955 | $1,603 |
| Propane Service Installation<br>Tank furnished and installed by local gas provider | 1 | $750 | $1,250 | $1,000 |
| Materials: $36,585 | | | | |
| 180' Guyed Tower Construction Materials | 1 | $17,500 | $27,500 | $22,500 |
| Small Telecom Cabinet<br>AMPROD AM47P-2636-24RU OR EQUIVALENT, ALUMINUM CABINET - FRONT AND REAR DOORS- HVAC/HEAT - ADJUSTABLE RACK RAILS 19" | 1 | $6,000 | $7,500 | $6,750 |
| Cabinet Foundation and Installation Materials | 1 | $1,000 | $1,500 | $1,250 |
| 10kW Liquid Propane Generator | 1 | $4,000 | $6,000 | $5,000 |
| Battery backup system | 1 | $905 | $1,265 | $1,085 |
| Total: | | | | $120,225 |
| Project Management, Network Engineering, Testing | | | | $38,420 |
| Site Engineering, Surveying, Viewshed Analysis, Etc. | | | | $9,500 |
| Misc Fees, Technical Services | | | | $7,500 |
| Site Acquisition, Land Lease | | | | $17,500 |
| Contingency | | | | $12,023 |
| TOTAL: | | | | $205,168 |

## 4.2 KEY AREA TWO: LONG RIDGE TOWER

Long Ridge is an existing tower that requires a load and structural analysis to determine if it can support additional radio antennas. The site may also need a new or upgraded generator, cabinet, and some electrical improvements before it would be ready for service provider (WISP) use.

Note that this estimate represents a "worst case" scenario. If the site already has a generator that can be used by a new WISP co-locating on the tower, that could reduce the cost by as much as $7,500. If no road improvements are needed and existing electric service does not require a new H-frame and meter, another savings of up to about $3,000 is possible. If the tower has a current certification (i.e. had a formal engineering inspection), additional savings are possible, bringing the 'best case" cost to about $11,000 to $12,000.

**Long Ridge Tower**

| ITEM/PROJECT | UNITS | UNIT COST LOW | UNIT COST HIGH | TOTAL (AVG) |
|---|---|---|---|---|
| Tower Fit-up Activities: $8,375 | | | | |
| Tower Study / Mapping / Load Analysis | 1 | $4,500 | $7,000 | $5,750 |
| Site Development (road repairs and general maintenance) | 1 | $0 | $1,500 | $750 |
| Fit-up: New Power Service / Installation<br>Assumes power available on site, new meter required to support WISP equipment | 1 | $1,250 | $2,500 | $1,875 |
| Labor and Contracting: $2,915 | | | | |
| New: Site Development (Clearing, Road Improvements, etc.) | 0 | $10,000 | $20,000 | $0 |
| New Site: New Power Service / Installation | 0 | $1,250 | $3,450 | $0 |
| 180' Guyed Tower Construction Labor & Contracting | 0 | $50,000 | $74,750 | $0 |
| Cabinet Installation Labor | 1 | $600 | $1,150 | $875 |
| Power System Installation Labor | 1 | $300 | $575 | $438 |
| Generator Installation Labor | 1 | $1,250 | $1,955 | $1,603 |
| Propane Service Installation<br>Tank furnished and installed by local gas provider | 1 | $750 | $1,250 | $1,000 |
| Materials: $14,085 | | | | |
| 180' Guyed Tower Construction Materials | 0 | $17,500 | $27,500 | $0 |
| Small Telecom Cabinet<br>AMPROD AM47P-2636-24RU OR EQUIVALENT | 1 | $6,000 | $7,500 | $6,750 |
| Cabinet Foundation and Installation Materials | 1 | $1,000 | $1,500 | $1,250 |
| 10kW Liquid Propane Generator | 1 | $4,000 | $6,000 | $5,000 |
| Battery backup system | 1 | $905 | $1,265 | $1,085 |
| Total: | | | | $26,375 |
| Project Management, Network Engineering, Testing | | | | $10,275 |
| Site Engineering, Surveying, Viewshed Analysis, Etc. | | | | $0 |
| Misc Fees, Technical Services | | | | $0 |
| Site Acquisition, Land Lease | | | | $0 |
| Contingency | | | | $2,638 |
| TOTAL: | | | | $39,288 |

## 4.3 KEY AREA THREE: MORELAND TOWNSHIP

The Moreland site would be used to place a new tower.

### Moreland Township

| ITEM/PROJECT | UNITS | UNIT COST LOW | UNIT COST HIGH | TOTAL (AVG) |
|---|---|---|---|---|
| Tower Fit-up Activities: $0.00 | | | | |
| Tower Study / Mapping / Load Analysis | 0 | $4,500.00 | $7,000.00 | $0.00 |
| Site Development (road repairs and general maintenance) | 0 | $0.00 | $1,500.00 | $0.00 |
| Fit-up: New Power Service / Installation<br>Assumes power available on site, new meter placement required to support WISP equipment | 0 | $1,250.00 | $2,500.00 | $0.00 |
| Labor and Contracting: $82,640.00 | | | | |
| New: Site Development (Clearing, Road Improvements, etc.) | 1 | $10,000.00 | $20,000.00 | $15,000.00 |
| New Site: New Power Service / Installation | 1 | $1,250.00 | $3,450.00 | $2,350.00 |
| 180' Guyed Tower Construction Labor & Contracting | 1 | $50,000.00 | $74,750.00 | $62,375.00 |
| Cabinet Installation Labor | 1 | $600.00 | $1,150.00 | $875.00 |
| Power System Installation Labor | 1 | $300.00 | $575.00 | $437.50 |
| Generator Installation Labor | 1 | $1,250.00 | $1,955.00 | $1,602.50 |
| Propane Service Installation<br>Tank furnished and installed by local gas provider | 1 | $750.00 | $1,250.00 | $1,000.00 |
| Materials: $36,585.00 | | | | |
| 180' Guyed Tower Construction Materials | 1 | $17,500.00 | $27,500.00 | $22,500.00 |
| Small Telecom Cabinet<br>AMPROD AM47P-2636-24RU OR EQUIVALENT, ALUMINUM CABINET - FRONT AND REAR DOORS- HVAC/HEAT - ADJUSTABLE RACK RAILS 19” | 1 | $6,000.00 | $7,500.00 | $6,750.00 |
| Cabinet Foundation and Installation Materials | 1 | $1,000.00 | $1,500.00 | $1,250.00 |
| 10kW Liquid Propane Generator | 1 | $4,000.00 | $6,000.00 | $5,000.00 |
| Battery backup system | 1 | $905.00 | $1,265.00 | $1,085.00 |
| Total: | | | | $120,225.00 |
| Project Management, Network Engineering, Testing | | | | $38,420.00 |
| Site Engineering, Surveying, Viewshed Analysis, Etc. | | | | $9,500.00 |
| Misc Fees, Technical Services | | | | $7,500.00 |
| Site Acquisition, Land Lease | | | | $17,500.00 |
| Contingency | | | | $12,022.50 |
| TOTAL: | | | | $205,167.50 |

# 4.4 SMALL CELL BROADBAND UTILITY POLE ACCESS COSTS

A single wooden utility pole with a wireless connection to a 180' tower and local access radios could provide access to any residence with line of sight within a half mile or more. This would spread the cost of pole construction and equipment costs across several households or businesses. There are many areas in the region where there is a cluster of homes along a relatively short stretch of road. All of those homes could share the use of a single local utility pole access site.

Community poles should only be located where a WISP and/or the community has made a minimum customer subscription commitment for the improved broadband service.

| V1 | VARIABLE | VALUE | NOTES |
|---|---|---|---|
| V2 | Weight Variable | 5 | 0-10 scale used in Best Estimate column (10 is best) |
| V3 | Towers | 1 | Number of Towers |
| V4 | Height | 60 | Tower Height |
| V5 | Type | Wooden Utility Pole | Tower Type |
| V7 | Backbone Radio System Licensed / Un-licensed | Un-licensed | WISP is responsible for radios and network equipment |
| V8 | Backbone Links | 1 | Typically a link to a taller tower |
| | Site Development (Average) | $1,000.00 | Poles need to be placed in locations with good line of sight to other poles or towers and where electric service and road access require minimal new construction |

| 1 | ITEM/PROJECT | UNITS | BEST ESTIMATE |
|---|---|---|---|
| 2 | Site Development (Clearing, Road Improvements, etc.) | 1 | $1,000 |
| 3 | 3x3 NEMA Box | 1 | $450 |
| 4 | New Power Service / Installation | 1 | $875 |
| 5 | 60' Wooden Utility Pole Construction Materials | 1 | $3,000 |
| 6 | Miscellaneous parts and materials | 1 | $175 |
| 7 | Power System Installation Materials | 1 | $30 |
| 8 | DC Voltage Monitoring Device | 1 | $50 |
| 9 | Unmanaged Rack Mount PDU (6O) | 1 | $40 |
| 10 | 60' Wooden Utility Pole Construction Labor & Contracting | 1 | $2,500 |
| 11 | Power System Installation Labor | 1 | $400 |
| 12 | Project coordination and management | 1 | $7,500 |
| 13 | Contingency (10% of costs) | 1 | $1,602 |
| 14 | Total: | | $16,020.00 |

## 4.5 POINT TO POINT COST ESTIMATE

The three key areas can be linked using high bandwidth point to point microwave radio links. This creates a single contiguous network. WISPs are often interested in having the point to point radio links included as part of their tower lease payments because it lowers their capital costs to provide service on more than one tower. Many counties also use the point to point tower network to carry K12 school traffic (a redundant network link), public safety data traffic, and to provide connectivity between county facilities (additional radio equipment may be needed).

A county-wide backhaul network between towers has several desirable characteristics:

- It reduces the cost to providers of being able to affordably offer service on all the towers.
- It increases the reliability and robustness of the WISP services because of the ring design (on at least four of the towers).
- County government data and/or public safety services could also be carried on the backhaul network to provide improved access to some remote facilities.
- K12 schools may be interested in having a redundant network to improve reliability of their existing fiber connections. This can be especially important during periods when online standardized testing is taking place.

To connect all four towers in the three key areas, three point to point radio links would be required. The table below provides cost estimates for a single point to point link.

The point to point system described in the table is the Ubiquiti AirFiber 11x Radio System. The radios operate on licensed frequencies. In ideal conditions, this system has a maximum throughput of 1.2Gbps and is capable of very long range links. Costs for licensing the link and costs for installation of the link are included.

AirFiber 11FX Pair Including Licensing

| Item | Units | Unit Cost | Total |
|---|---|---|---|
| AF11X Radio | 2 | $799 | $1,598 |
| AF11-CA Adapter Kit | 2 | $49 | $98 |
| AF11FX Duplexer | 4 | $199 | $796 |
| AF11 X Antenna 11GHz, 35dBi | 2 | $379 | $758 |
| FCC Licensing | 1 | $2,000 | $2,000 |
| Shipping @ 5% | 1 | | $263 |
| Install, Configure and Align | 1 | $9,500 | $9,500 |
| TOTAL | | | $15,013 |

# 4.6 ACCESS RADIO EQUIPMENT COST ESTIMATE

If a tower is leased out to a service provider, most WISPs prefer to install their own access radios on the tower. The access radios propagate the Internet data signal to customers with line of sight to the tower. This generally a better way for the county or tower owner to manage access, as the WISP is responsible for all of the tower radios and customer premises equipment (CPE) radios.

In some cases, there may be a reason for the county or the tower owner to own and manage the access radios. For example, service is badly needed in the area around the tower but a WISP does not feel they can gain enough customers to justify the cost. In this case, the tower owner (e.g. the county) may choose to put radios and offer Internet service to meet local business and resident needs. The cost of providing radios to thirty customers has been included in this estimate.

The estimate table below shows the costs for 2 sets of access points, one licensed, and one unlicensed. It is common for a WISP to install multiple sets of access points on a tower and choose the best frequency based on performance when at the customer premise. The licensed equipment costs shown below are based on the Cambium PMP450 platform in 3.65GHz frequencies, the same frequency as LTE. The unlicensed equipment costs shown below are based on the costs for Ubiquiti 5GHhz access points. In completely clear line of sight conditions the WISP is likely to utilize the Ubiquiti radios, when line of sight is partially blocked the LTE frequencies will likely perform better. Both technologies can deliver broadband speeds exceeding 25/3Mbps and the maximum capacity that a customer can receive will vary based on their wireless connection and the other customers on the access point.

Costs are included in the estimate for the installation of the access points.

| **Access Equipment Costs: $29,389** | | | | |
|---|---|---|---|---|
| ITEM | UNITS | LOW | HIGH | AVERAGE |
| Licensed Access Equipment (3x120° Sectors) | 1 | $9,925 | $12,925 | $11,425 |
| Licensed CPE Radios and Mounts | 30 | $288 | $338 | $9,390 |
| Unlicensed Access Equipment (3x120° Sectors) | 1 | $394 | $444 | $419 |
| Unlicensed CPE Radios and Mounts | 30 | $104 | $154 | $3,870 |
| Site Switching | 1 | $164 | $214 | $189 |
| Cabling | 1 | $110 | $160 | $135 |
| Equipment Shipping | 1 | $1,099 | $1,424 | $1,261 |
| Access Point Installation | 1 | $1,800 | $3,600 | $2,700 |
| TOTAL | | | | **$29,389** |

## 4.7 LEASING TOWER SPACE

Once existing and/or new towers have space available to lease to WISPs, there are policy and contract decisions that must be evaluated.

- There should be a single public fee schedule for all providers.
- There should be a single tower space agreement that is used for all providers.
- Tower access should be made available in ten foot vertical segments, as high as possible on the tower without interfering with other uses (e.g. public safety antennas). Note that it is unlikely that any tower will have more than two providers on it.
- Leases should be a minimum of two years and should auto-renew if the ISP is meeting performance requirements.
- It may be more effective to have a single lease agreement with access to all towers, and the contract should require the ISP to put equipment on all towers within a certain period of time (e.g. nine to twelve months). This limits ISPs from "cherry picking" towers with more potential customers and ignoring towers in parts of the county with lower population density.
- Monthly tower lease fees should be on the order of $200 to $250 per tower. Higher fees make it difficult for providers to make a business case for the cost of equipment and the extensive marketing required to develop a customer base around a tower.
- If there are two vertical spaces available for lease, the lower segment could be made more attractive to a WISP by offering a reduced lease fee.
- An initial grace period of three to six month should be offered on fees, and/or offer a one year sliding scale of fees (e.g. first three months, fee waived; months four to six, 25% of normal fee; months seven to nine, 50% of normal fee; months ten to twelve, 75% of normal fee). There are many ways to structure the initial fee period, but it is important to recognize that the WISPs incur substantial early costs to develop revenue and customers for a new tower.
- All tower leases should expire on the same date even if started at different times. This allows the regional enterprise to potentially make a smoother transition to a new provider if there are performance issues, and will give the regional entity more leverage and control over the WISPs.
- In contracts, fee reductions should be worded as discounts that can be revoked if performance requirements are not adequately being met.
- There are considerations for ground-space (e.g. WISP cabinets, shelters, H-frames for electric service) that will have to be evaluated at each tower site. If new shelters will be allowed, the regional entity should set minimum standards for new shelters.

### Tower Space Revenue Estimate

Tower revenue opportunities are limited. It takes WISPs many months to acquire enough customers on a new tower to break even, and even longer to begin to show a profit. Fees for tower space need to be modest to attract one or two providers, and it is good practice to offer several months of free service while the WISP markets in the new service area and tries to sign up customers.

Because of interference problems, two providers are the most that are desirable on a tower, and offering towers on an exclusive basis (e.g. an open auction for tower space) could bring in more revenue from a single provider.

Sample Tower Leasing Revenue Projection

| Service Item | Description | Monthly Fee | Max Number of WISPs per Tower | Projected Annual Revenue |
|---|---|---|---|---|
| Tower Space on One Tower | 10 feet of vertical space leased to one ISP | $200 | 1 | **$2,400** |
| Tower Space on Three Towers | 10 feet of vertical space leased to one ISP | $200 | 1 | **$7,200** |
| Tower Space for Six Towers | 10 feet of vertical space leased to one ISP | $200 | 1 | **$14,400** |

## Tower Space Operational Expenses

Assumptions include:

- Each provider on a tower will install their own electric service (meter) and pay their own utility costs.
- Site leases on private land can be negotiated for $1000/year with a single up-front payment of $10,000 (for ten years).

If several towers are available (e.g. three, four), there will be some efficiencies gained in costs so that revenue would likely exceed expenses–costs like legal services and insurance will not increase proportionally with more than one tower.

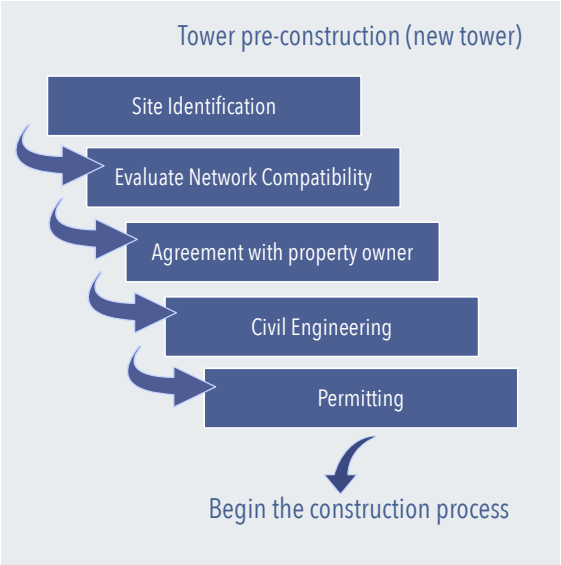
Tower Lease Annual Expense Projections

| Budget Item | Description | Annual |
|---|---|---|
| Legal Services | Legal counsel on an as-needed basis for review of construction and service contracts, IRU agreements, and other business documents. | **$1,500** |
| Accounting | Part time accounting and bookkeeping services will be required | **$2,400** |
| Generator Maintenance/ Fuel | Generators require periodic maintenance and occasional fuel (propane) tank refills. | **$950** |
| Site Maintenance | Routine tasks like trimming weeds and grass around the tower. | **$600** |
| Site Leases | Some towers may be placed on private property which would require annual site leases. This will vary depending on the availability of local government properties that may be available for tower placement. | **$1,000** |
| Insurance | Some insurance is likely to be needed (general liability, unemployment, asset insurance, umbrella policy). | **$2,500** |
| Total Costs | **Projected annual expenses** | **$8,950** |

# 4.8 TOWER SITE AND TOWER MANAGEMENT

## Tower Site Identification

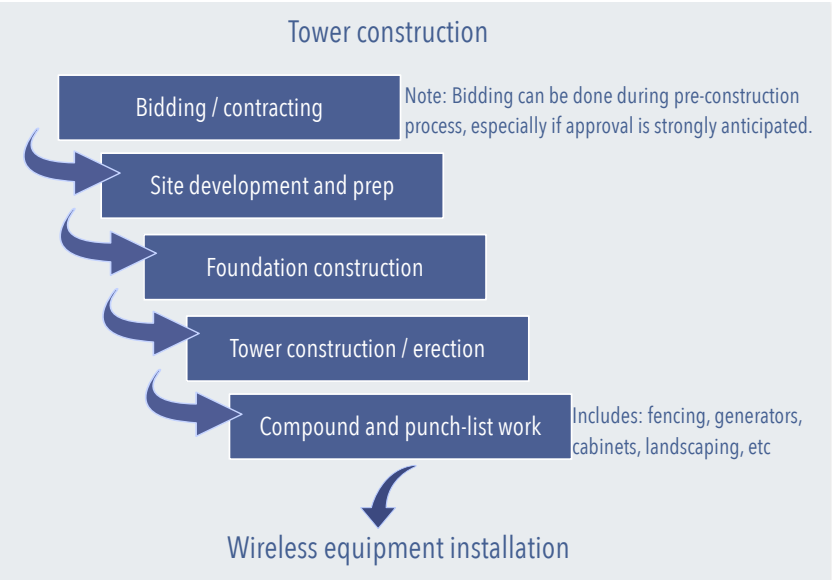
When a site for a new tower is being considered for use, the diagram below illustrates the steps that need to be followed. For example, if an existing public safety tower or an existing cellular provider tower may have space for fixed point wireless broadband equipment (i.e. co-location).




- Site identification – Identify areas of poor service and look for existing towers.
- Network Compatibility – Line of sight to other towers and to key service locations and customers needs to be evaluated. A wireless propagation study and line of sight study will provide the data needed to make this determination.
- Property owner negotiation – A lease has to be negotiated with the property owner. Local government sites (e.g. K12 schools, parks, recreation areas, fire/rescue stations) are candidates for towers because of reduced or no lease fees.
- Engineering – An engineered site plan will be required to as part of the permitting process.
- Leases and permits – A permit to place the tower is required in most localities, and there may be a multi-stage permitting process that can take several months.

## Tower Construction

Once the engineering work is completed and a construction permit has been issued, tower construction can proceed. For a typical fixed point wireless tower of 199' feet or less, construction usually takes less than a month, but weather and soil conditions can create delays.




- Bidding and contracting – Bid documents and construction specifications have to be prepared and sent

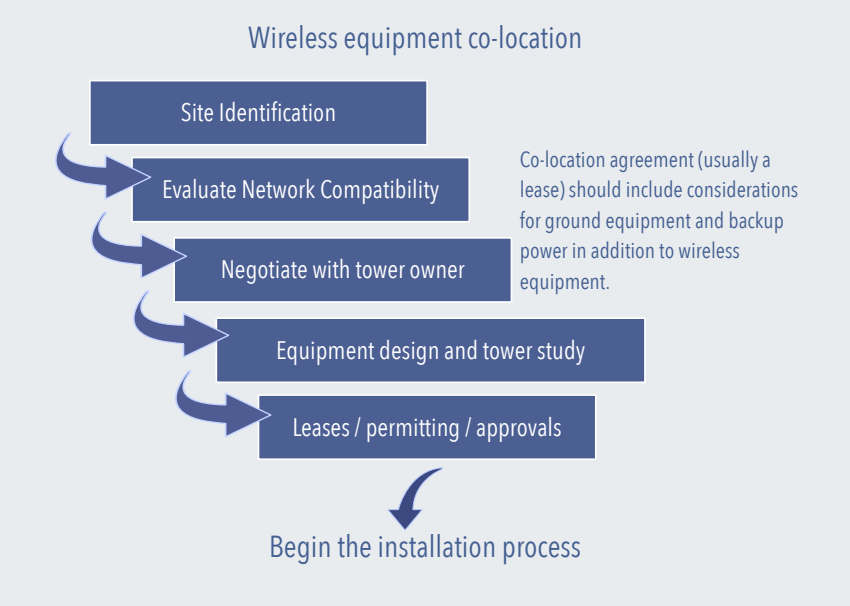
to candidate contractors. Once bids are received, proposals have to be reviewed, and depending upon funding sources, may require review by local government and/or a funding agency prior to awarding a contract.

- Site development – The tower site has to be cleared of trees, brush, and any other obstructions. The area directly around the tower has to be leveled, and electric service (underground or aerial) has be brought to the site. Depending upon the location a road (usually gravel) may have to be placed.
- Foundation construction – Once site clearing and any road work is completed, the foundation for the tower is installed. If it is a guyed tower, guy wire anchors have to be installed.
- Tower construction – Once the foundation is in place, the tower is erected. For towers of 199′ or less, this is usually only two days.
- Final work details – Once the tower is in place, final work items are completed, including fencing, generators, fuel tanks, landscaping, and any site restoration work.

## Wireless Equipment Co-Location

When an existing tower is being considered for use, the diagram below illustrates the steps that need to be followed. For example, if an existing public safety tower or an existing cellular provider tower may have space for fixed point wireless broadband equipment (i.e. co-location).

- Site identification – Identify areas of poor service and look for existing towers.
- Network Compatibility – If there are towers in the service area, the first step is to determine if a minimum of ten vertical feet of space is available at an appropriate height for broadband wireless equipment. A wireless propagation study will provide the data needed to make this determination.

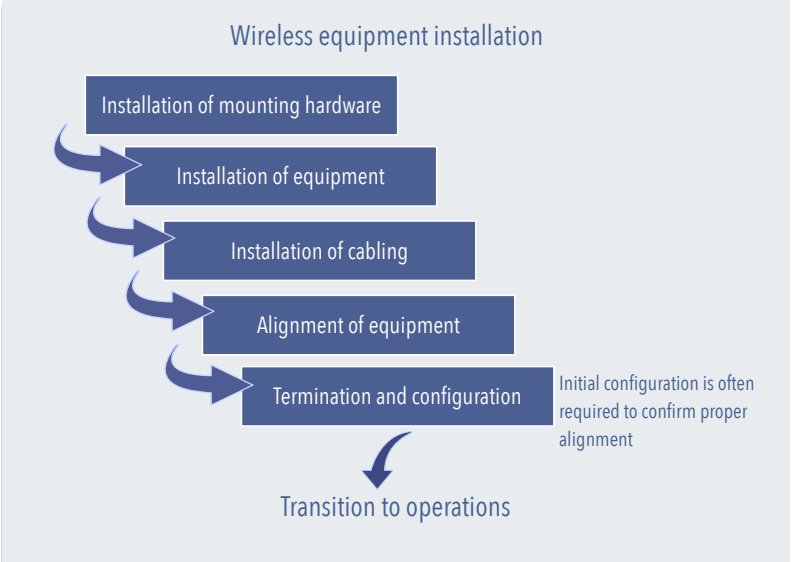



- Tower owner negotiation – If the tower is in a suitable location and if space is available at an appropriate height, a lease has to be negotiated with the tower owner.
- Tower study – An engineering study may be required to determine if the tower is able to support the additional weight and wind load of the equipment. Additional electric service and a cabinet for network electronics may also be needed.

- Leases and permits – If new electric service and/or a cabinet or shelter has to be installed at the sight, local government permits and/or construction approvals may be required.

## Wireless Equipment Installation

Wireless equipment installation follows the completion of construction on a new tower or the acquisition of space on an existing tower. Electric power is already in place.




- Mounting hardware – Brackets and other mounting hardware have to attached to the tower at the designated height. This requires a tower climb conducted by a firm with trained tower climbers.
- Equipment installation – Once the mounting hardware is in place, radios are attached to the tower. On the ground, network equipment including switches, powers supplies, battery backup, and other equipment is installed. A backup generator and fuel tank may also be installed and wired into the equipment cabinet or shelter.
- Cabling installation – Cables are connected between the equipment in the cabinet on the ground to the radios on the tower.
- Alignment of radios – Radios on the tower have to be adjusted. Local access radios that provide service to local customers with line of sight to the tower have to be aligned for optimum coverage. If there are also point to point radios on the tower for connections to other towers or locations, these also have to be aligned. Tower climbers are needed to perform these steps.
- Configuration and testing – Once the physical alignment of the radios is complete and all cabling is connected, the new network equipment is integrated into the rest of the network.

# APPENDIX A: GLOSSARY

**Active network:** Typically a fiber network that has electronics (fiber switches and CPE) installed at each end of a fiber cable to provide "lit" service to a customer.

**Asymmetric connection:** The upload and download bandwidth (speed) are not equal. Cable Internet and satellite Internet services are highly asymmetric, with upload speeds typically 1/10 of download speeds. Asymmetric services are problematic for home-based businesses and workers, as it is very difficult to use common business services like two way videoconferencing or to transfer large files to other locations.

**Backhaul:** Typically refers to a high capacity Internet path out of a service area or locality that provides connectivity to the worldwide Internet.

**Colo facility:** Colo is short for Colocation. Usually refers to a prefab concrete shelter or data center where network infrastructure converges. A colo or data center can also refer to a location where several service provider networks meet to exchange data and Internet traffic.

**CPE**: Customer Premises Equipment, or the box usually found in a home or business that provides the Internet connection. DSL modems and cable modems are examples of CPE, and in a fiber network, there is a similarly-sized fiber modem device.

**Dark fiber:** Dark fiber is fiber cable that does not have any electronics at the ends of the fiber cable, so no laser light is being transmitted down the cable.

**Fiber switch:** Network electronic equipment usually found in a cabinet or shelter

**Fiber Optic Splice Closure:** See **FOSC**.

**FOSC:** Fiber Optic Splice Closure. Typically a water and air tight cylindrical container where fiber cable is split open to allow splicing (connecting together) of fiber strands for a drop to a premises.

**FTTH/FTTP/FTTx:** Fiber to the Home (FTTH), Fiber to the Premises (FTTP), and Fiber to the X (FTTx) all refer to Internet and other broadband services delivered over fiber cable to the home or business rather than the copper cables traditionally used by the telephone and cable companies.

**Handhole**: Handholes are open bottom boxes with removable lids that are installed in the ground with the lids at ground level. The handholes provide access to fiber cable and splice closures that are placed in the handhole. Handholes are also called **pull boxes**.

**IP video:** Video in various forms, including traditional packages of TV programming, delivered over the Internet rather than by cable TV or satellite systems.

**Latency:** The time required for information to travel across the network from one point to another. Satellite Internet suffers from very high latency because the signals must travel a round trip to the satellite in stationary orbit (22,500 miles each way). High latency makes it very difficult to use services like videoconferencing.

**Lit network:** A "lit"network (or lit fiber) is the same as an active network. "Lit" refers to the fact that the fiber equipment at each end use small lasers transmitting very high frequency light to send the two way data traffic over the fiber.

**MST**: Multiport Service Terminals are widely used in fiber to the home deployments to connect individual home drop cables to larger distribution cables on poles or in handholes. Pre-connectorized drop cables snap into the MST ports and do not require any splicing.

**Passive network:** Refers to infrastructure that does not have any powered equipment associated with it. Examples include wireless towers, conduit (plastic duct), handholes, and dark fiber.

**Pull boxes:** Pull boxes (also called handholes) are used to provide access to fiber cable and splice closures. They are called pull boxes because they are also used during the fiber cable construction process to pull the fiber cable through conduit between two pull boxes.

**Splice closures:** Splice closures come in a variety of sizes and shapes and are used to provide access to fiber cable that has been cut open to give installers access to individual fiber strands. Splice closures are designed to be waterproof (to keep moisture out of the fiber cable) and can be mounted on aerial fiber cable or placed underground in handholes. Also called **FOSC**s.

**Splicing**: The process of providing a transparent joint (connection) between two individual fiber strands so that laser light passes through. A common use of splicing is to connect a small "drop" cable of one or two fiber strands to a much larger (e.g. 144 fiber strand) cable to provide fiber services to a single home or business.

**SCADA**: Supervisory Control and Data Acquisition. Used by the electric utility industry and some other utilities (e.g. water/sewer) to manage their systems.

**Symmetric connection:** The upload and download bandwidth (speed) is equal. This is important for businesses and for work from home/job from home opportunities.

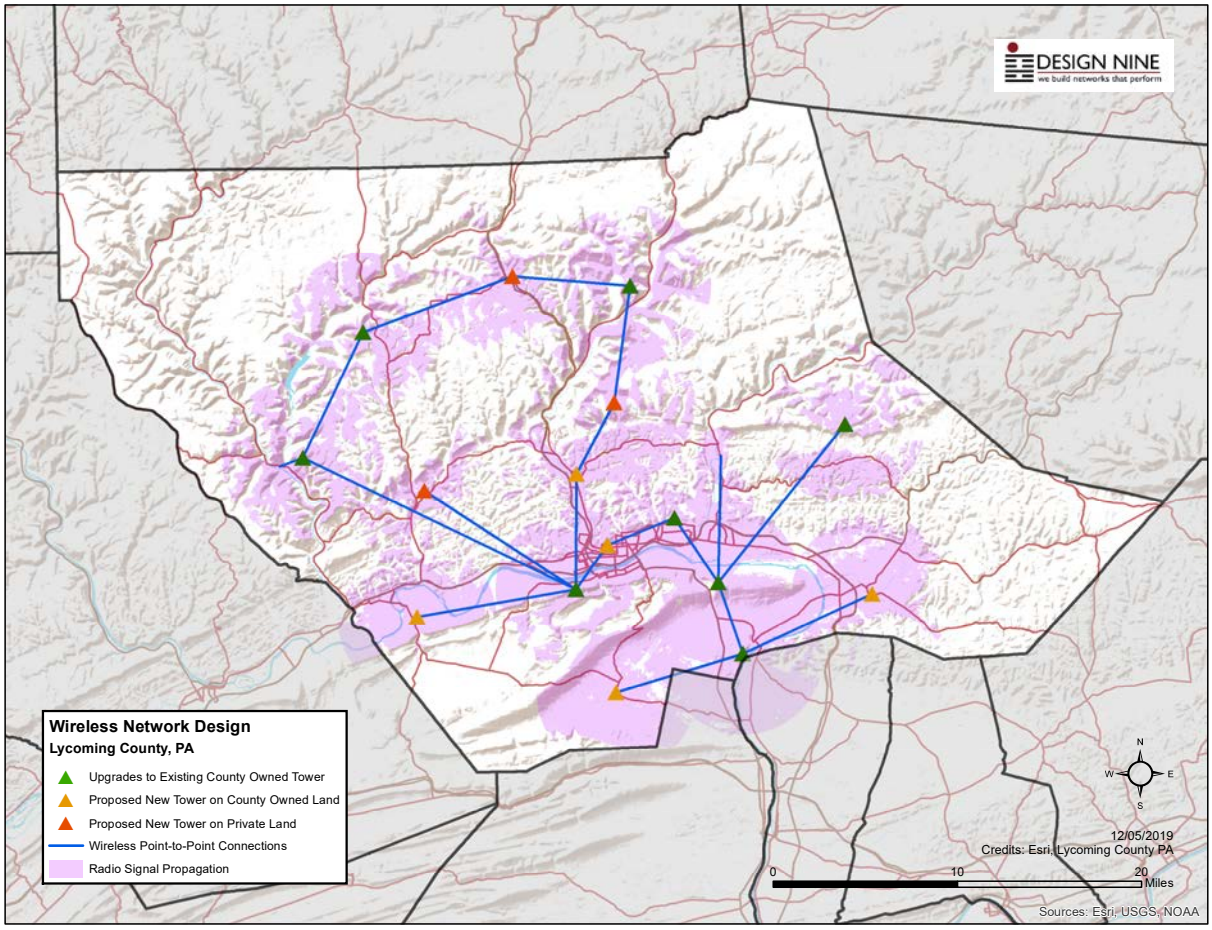
**Virtual Private Network:** A VPN creates a private, controlled access link between a user's computer and a corporate or education network in a different location. VPNs are often encrypted to protect company and personal data. VPNs usually require a symmetric connection (equal upload and download speeds) to work properly.

# APPENDIX B: COUNTY-WIDE WIRELESS COST ESTIMATE

In Lycoming County, it was possible to design a partially redundant network, with a redundant wireless loop in the west-central portion of the county. Eight county-owned towers were identified as candidates for the network.

Those towers will require a structural analysis to determine if additional equipment can be added to the tower (a structural analysis generally costs $2,500 to $5,000). Improvements to these existing towers could bring better service quickly to some portions of the county, and additional towers and poles could be added incrementally.

The network design is estimated to cover 72% to 76% of all addresses in the county.



## Lycoming County-wide Fixed Wireless Estimate

| SITE | DESCRIPTION | TOTAL COST |
|---|---|---|
| Antes Fort FD | New Tower Required, Wide Area Coverage | $218,323 |
| Williamsport West | Tower Fit-up, Wide Area Coverage | $75,460 |
| Stevens Primary School | New Tower Required, Wide Area Coverage | $221,079 |
| Williamsport East | Tower Fit-up, Wide Area Coverage | $67,191 |
| Montoursville | Tower Fit-up, Wide Area Coverage | $72,704 |
| Montgomery | Tower Fit-up, Wide Area Coverage | $69,948 |
| Elimsport | New Tower Required, Wide Area Coverage | $218,323 |
| Muncy Creek Township | New Tower Required, Wide Area Coverage | $218,323 |
| Long Ridge | Tower Fit-up, Wide Area Coverage | $64,435 |
| Loyalsock Valley Elementary School | New Pole (School), Small site equip. | $20,550 |
| Hepburn-Lycoming Primary School | New Tower Required, Wide Area Coverage | $221,079 |
| Gamble Township | New Tower Required, Wide Area Coverage | $221,079 |
| Shivers Ridge | Tower Fit-up, Wide Area Coverage | $67,191 |
| Saladasburg | New Tower Required, Wide Area Coverage | $218,323 |
| Steam Valley | New Tower Required, Wide Area Coverage | $221,079 |
| English Center | Tower Fit-up, Wide Area Coverage | $67,191 |
| Waterville | Tower Fit-up, Wide Area Coverage | $69,948 |
| Waterville VFD | New Pole (School), Small site equip. | $20,550 |
| | | **$2,352,773** |