Chenango County
Broadband Feasibility Study

Prepared by:

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Introduction

Current State of Telecommunications and the Digital Divide

Twenty years ago, the Federal Communications Commission (FCC) created the Telecommunications Act of 1996 to establish competition and facilitate growth in the telecommunications industry. Prior to 1996, the telecommunications industry was a government regulated monopoly. After the Telecommunications Act, competitive telephone companies called competitive local exchange carriers or CLECs emerged and provided consumers with a choice of providers and services. During the same period of time, other non-traditional telecommunications providers emerged. These new players to the telecom industry, namely the cable TV providers, network providers, and wireless providers (both cellular and fixed wireless) appeared and offered alternative and competitive broadband services as well.

Many years have passed since the 1996 Telecommunications Act, which succeeded in creating an increase in competition and the availability of broadband access. Despite that success, a technology division has occurred: a division between areas of the country that have access to affordable broadband service and those that do not. This division of broadband service has been labeled the "digital divide".

In a real sense, telecommunications and broadband access has become one of the foundation resources that allow a community to compete and thrive in the 21st century. Broadband access has become infused into all facets of our society and is essential to our daily lives. Familiar examples of this include smart grid technology at the home, telemedicine at the doctor's office, social media and web browsing on handhelds, distance learning at schools, and email at the workplace. It would be hard to imagine life without broadband access.

However, there are still areas of the country that lack the affordable high bandwidth service that is so attractive to both businesses and residential customers – those on the "have not" side of the digital divide. This is due in large part to a perceived lack of return on investment for the incumbent service providers and a lack of competition by alternative providers in low income and rural areas of the country. It is therefore prudent to make an assessment on the current state of telecommunications in a given area and to plan for the future.

Commission of the Study

In October of 2015 the Southern Tier East Regional Planning and Development Board, working with the Chenango County Planning Department, contracted with ECC Technologies, Inc. to perform a Broadband Feasibility Study in Chenango County. The purpose of the study was to assess current broadband assets and limitations, necessary changes, and needed financial investments to assure that adequate broadband speeds are delivered to the rural residents and businesses of Chenango County. The study methodology was to gather and document broadband infrastructure and services information, and to provide analysis and initiative for moving forward, which will be used to support economic development and County planning.

The Scope of Work of the Study was to:

1. Perform a Fiber Optic Asset Inventory;

2. Conduct a Needs Assessment;

3. Develop a Business Plan based on a Fiber Strategy; and

4. Provide a Fiber Strategy and Report.

The information compiled by ECC Technologies, Inc. is presented in the following pages of this report. Much of this information has also been placed into an interactive electronic geographic information system (GIS) database by ECC. This database tool consists of interactive mapping elements that can be used to identify and locate the major telecommunications resources within the area for economic development and County planning purposes.

ECC Technologies, Inc. contact information:
2136 Five Mile Line Rd. Penfield NY 14526: (585) 377-1850

Research Methodology

To gather the information required for this study, ECC Technologies contacted the major telecommunications providers listed below and performed field surveys, or "windshield surveys," to identify and document outside plant (OSP) cabling infrastructure. The data was used to refresh and bring up to date the information gathered during the 2004 Southern Tier East Telecommunications Inventory Study. Publicly available databases managed by Federal and State agencies and information purchased from telecom industry database research organizations were additional sources used to complete the inventory.

Wire Line Providers

- Incumbent Local Exchange Carriers (ILECs)

- Cable TV (CATV)/Modem Service Providers

- Competitive Local Exchange Carriers (CLECs)

- Network Service Providers

- Dark Fiber Providers

<u>Wireless Providers</u>

- Cellular

- Wireless Internet Service Providers (WISPs)

Public Information

ECC obtained telecommunications industry data publicly available from the following Federal and State organizations: the FCC, the NYS GIS Program Office, and the NTIA. On the local level, ECC obtained information from Commerce Chenango and the County Planning Department.

Contacted Providers

Many of the telecommunications providers in the County were contacted via telephone, in person, and/or by email. Each organization contacted identified the appropriate individual within their respective company and that person was informed of the study and its intent.

Industry Resources

Other resources included GeoTel and Telecordia, telecommunications industry research companies, telecommunications provider websites, telecommunications industry professionals, and outside plant professionals that conducted outside plant (windshield) surveys for telecommunications infrastructure identification. All information gathered was to the extent possible.

GIS Mapping/Database

All infrastructure information discovered in this inventory project has been integrated into a GIS database developed for Chenango County. This GIS database will be administered, stored, and updated by the Planning Department of Chenango County to ensure security and continuity of the resource.

The GIS database of information was developed to support broadband based and economic development initiatives. This information will be used by the Planning Department for County and local level use. The maps included in this report represent the area's broadband infrastructure documented in the fall/winter of 2015/2016.

Fiber Optic Asset Inventory

Field Inventory

In 2004 ECC performed a Telecommunications Inventory Study for the Southern Tier East Regional Planning and Development Board. That study included Chenango County. The data collected in this study was used to refresh and bring up to date the information gathered during the 2004 study.

In this study we found that telecommunications in the County is delivered via a number of competing providers using different technologies and infrastructures. The primary owners of telecommunications infrastructure in the County include the incumbent telephone companies, which are Frontier Communications and TDS Telecommunications Corporation (Deposit Tel); the incumbent cable TV providers, which are Time Warner Cable (TWC) and Adams Cable Services; one regional fiber based provider, ION Networks; one competitive local exchange carrier, Finger Lakes Technology Group; two wireless Internet service providers (WISPs), Plexicomm LLC and Clarity Connect; and a number of cell phone carriers.

The telecommunications providers in Chenango County are delivering service to homes, businesses, and other organizations at varying degrees of access, performance, and cost. As compared to the 2004 inventory, **REMOVED DUE TO CONFIDENTIALITY CONCERNS**

. The more rural areas continue to be unserved or underserved with some limited DSL service available. The cable TV providers have made an investment in fiber optic cable in the more populated areas of the County.

There are 27 wireless towers, either registered on the FCC website or confirmed by field study, constructed in Chenango County (**REMOVED FOR PUBLIC SAFETY CONCERNS**). The majority of these towers are located on **REMOVED FOR PUBLIC SAFETY CONCERNS**.

The service coverage of a typical cellular equipped tower can be anywhere between one and 20 miles depending on the equipment in use, how the equipment is set up, terrain, and the height of the towers. The locations of the cell towers clearly depict the cell coverage of the county which is relatively strong in the center of the county but is more limited west of NY State Route 12.

The map on the following page shows the data ECC collected during the Inventory. It provides insight to where the infrastructure is located and where improvements could be made. Fiber has been identified to the extent possible. Fiber installed underground may not be pictured. The pages following the inventory map provide additional detail of the data collected.

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ILECs

There are two incumbent local exchange carriers (ILECs) that provide service in Chenango County. The ILEC is responsible for development and maintenance of the cabling and switching equipment needed to deliver local telephone and other telecom related services to the communities. The ILECs providing service within the county are Frontier Communications (Citizens) and TDS Telecommunications.

Frontier Communications

Frontier has a corporate office located in Rochester, NY. They are a full service telecommunications provider and one of the largest rural local exchange telephone companies in the country. They provide local phone and Internet service. Their ILEC territory is the largest of the local phone providers in the region. Frontier Communications offers telephone and Internet services, including copper based DSL, as well as bundled offerings. Frontier will also provide fiber connectivity for business customers as needed. Frontier covers the majority of the county with only the Afton area served by another provider.

TDS Telecommunications Corporation

TDS Telecommunications Corp. (TDS®), is a wholly owned subsidiary of Telephone and Data Systems, Inc. In addition to residential service the company offers businesses advanced solutions, including VoIP (managed IP Hosted voice), high-speed Internet fiber optics, data networking, and hosted-managed services in the Afton area of the County.

The table on the following page shows each ILEC's Central Offices and the services available.

Central Office (ILEC)	Exchanges	MPLS	DSL	T1/DS1	T3/DS3	GIGE
TDS Telcom						
Afton	607-739	Yes	Yes	Yes	Yes	Yes
Frontier						
Bainbridge	607-967	Yes	Yes	Yes	Yes	Yes
Cincinnatus	607-863	Yes	Yes	Yes	Yes	Yes
Earlville	315-691	Yes	Yes	Yes	Yes	Yes
Greene	607-656	Yes	Yes	Yes	Yes	Yes
Guilford	607-226, 607-895	Yes	Yes	Yes	Yes	Yes
McDonough	607-647	Yes	Yes	Yes	Yes	Yes
Mount Upton	607-764	Yes	Yes	Yes	Yes	Yes
New Berlin	607-847	Yes	Yes	Yes	Yes	Yes
Norwich	607-337,607-335,607-336,607-337	Yes	Yes	Yes	Yes	Yes
Oxford	607-843	Yes	Yes	Yes	Yes	Yes
Sherburne	607-674	Yes	Yes	Yes	Yes	Yes
Smyrna	607-627	Yes	Yes	Yes	Yes	Yes
S. Ostelic	315-653	Yes	Yes	Yes	Yes	Yes
S. New Berlin	607-859	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 1 – Chenango County Central Offices

The following map shows the service territories of the two ILECs and where their fiber assets have been deployed. It also shows the locations of the central offices in the County. All of the central offices are connected by fiber.

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CLECs

As stated previously, competitive local exchange carriers (CLECs) are a direct result of the 1996 Telecommunications Act, which gave these companies the right to use ILEC infrastructure to deliver competing services. A switched-based CLEC is a company that owns switching equipment for local voice and data services. Since they own their equipment/switches they can provide some competition to the incumbent, offering equipment based redundancy over ILEC services. There was one CLEC identified (Finger Lakes Technology Group) in Chenango County during the study process.

Finger Lakes Technology Group (FLTG)

Finger Lakes Technologies Group, Inc. (FLTG) is headquartered in Victor, NY. The company has connections from Binghamton to Syracuse, Rochester, and Elmira. FLTG serves the Finger Lakes region of New York. FLTG owns and operates a 2,500-mile fiber network in New York State. FLTG has built fiber between Binghamton and Syracuse, **REMOVED DUE TO BUSINESS CONFIDENTIAL MATERIAL**. They are very interested in providing competitive pricing to any business along their fiber network. **REMOVED DUE TO BUSINESS CONFIDENTIAL MATERIAL.**

The map on the following page shows FLTG's fiber in Chenango County.

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Fiber Based Providers

Fiber based providers are similar to a CLEC in that they offer competition to the ILEC. To enter a new marketplace, fiber based providers will either lease fiber from the incumbent or another fiber owner or build their own fiber to access customers. Since fiber is expensive to install, these types of providers will look for high dollar, long term contracts for their service from anchor customers that have multiple locations and high bandwidth needs. Typical anchor customers of fiber based providers include school districts, government, large healthcare systems, and cellular providers. These types of customers help the fiber based provider recoup a large portion of the initial cost to build the fiber.

ION Networks

ION is a not-for-profit statewide fiber network headquartered in Albany, NY. The company was originally formed in 2004 by 12 regional ILECs. In 2009 they were awarded $40 million from the federal stimulus grant to build-out their network. They have approximately 3,000 route miles of fiber in New York.

Their primary focus is on service education, healthcare, and other service providers operating in the rural areas of New York. They do not offer residential service. Their parent company is Sovernet, which is based in Vermont.

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A map of ION's network in located on the following page.

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Cable Providers

Time Warner Cable

Time Warner Cable's (TWC) corporate headquarters is located in New York City. TWC's territory includes a significant part of the more populated areas of the County and provides strong competitive services to the incumbent's DSL service for residential areas. Towns TWC does not provide service to are Lincklaen, Columbus, Pharsalia, German, McDonough, Preston and Smithville.

TWC's Internet access service is available in multiple levels of bandwidth, including 2Mbps down and 1Mbps up to 50Mbps down by 5Mbps up. TWC has installed a large quantity of coaxial cable throughout the territory. They also have a limited amount of fiber with the majority of it routing along the major highway corridors and in more populated areas.

It is worth noting that TWC merged with Charter Communications in May of 2016. The company will eventually be rebranded as Spectrum Communications. A date for the rebranding had not been set at the writing of this report. The newly formed company will become the second largest cable provider in the United States and the third largest video provider.

Adams Cable Service

Adams Cable provides typical cable services in the area of the Town of Afton. They offer triple play with Internet speeds up to 25Mbps for residential and fiber Internet for businesses (if available) up to 500Mbps. Their main office is in Carbondale, PA.

On the following page is a CATV map showing provider territory and fiber and coaxial infrastructure. The map does not show fiber and coax in the developed areas, unless the incumbent service provider or cable company provided their network maps. It is understood that coax and fiber exists within the villages and cities.

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Wireless Providers

Fixed wireless service providers are commonly called Wireless Internet Service Providers (WISPs). WISPs offer WiFi broadband technology utilized in the 900MHz, 2.4GHz, and 5GHz unlicensed radio frequency bands developed under and in compliance with the 802.11 international standards. WISPs can be the most cost effective technology for serving rural unserved and underserved markets, particularly when the terrain is mountainous and the cost of building out last mile fiber optic infrastructure is prohibitive. The cost of entry into the market using these technologies is much less than the cellular broadband carriers, and may be incrementally implemented. These factors can make a WISP a preferable option in many unserved areas' circumstances.

Fixed wireless technologies require wireless access points (APs), which can be located on radio towers, tall buildings, utility poles, or other high structures. Remote households receiving broadband service will require a roof mounted antenna that will feed an indoor modem. Internet service is then available at the modem, and can be redistributed to an in-home wired or wireless network.

WISPs can be an attractive alternative to traditional landline services. In many cases, customers of WISPs can avoid very costly landline builds, resulting in more affordable bandwidth. In many areas of the state WISPs fill the void in unserved and underserved areas. There are two WISPs currently operating in Chenango County.

Plexicomm Internet Solutions

Plexicomm LLC is based in Binghamton, NY. They provide wireless Internet services in limited areas of the County. **REMOVED DUE TO BUSINESS CONFIDENTIAL MATERIAL** although speeds can vary depending on the end-user's distance from the tower locations and whether there is a direct line of sight. Plexicomm also offers phone and web hosting services. They provide both residential and business services. In areas outside of Chenango County, Plexicomm has built their own fiber and will also construct fiber for other entities.

Clarity Connect

Clarity Connect is based in Ithaca, NY. Their service area in Chenango County is limited to small pockets in Guilford, Bainbridge, and Afton. Clarity Connect offers Internet and email services to both the residential and business markets.

The map on the following page shows Plexicomm's and Clarity Connects coverage areas in Chenango County. Both wireless providers indicated that having access to vertical assets such as wireless towers and water towers in the County would allow them to expand and provide services into the unserved areas of the County. The high cost of tower rental fees (which can sometimes be up to $1500 per month) and backhaul from the towers to their core networks are barriers to entry for providers seeking to expand into unserved areas. Favorable conditions for these providers to expand service in the County would be if fiber was available to these vertical assets at a reasonable cost and tower access could be provided by the County. They would then be able to expand services to cover underserved areas.

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Cellular Service Providers

The cellular providers in the County are AT&T Wireless, Verizon Wireless, T-Mobile, and Sprint. All of these cellular companies have equipment on towers strategically placed in the County to provide mobile wireless service to the maximum number of customers. **REMOVED DUE TO BUSINESS CONFIDENTIAL MATERIAL**

Wireless Towers

The towers used by the cellular service providers are owned by a number of different corporations**.** There are 18 private sector towers in the County. All of these are along or to the east of State Route 12 (see map for locations).

Wireless Tower Owners	
American Towers, (7 TOWERS) Compliance Dept., FAA/FCC 10 Presidential Way Woburn MA 01801 (678) 564-3236	**SBC Tower Holdings (1 TOWER)** Reginald Youngblood 3300 E. Reiner Rd. Richardson, Tx. 75082 (855) 699-7073
Crown Atlantic Company (3 TOWERS) Don Snyder 2000 Corporate Drive Canonsburg, PA 15317 (724) 416-2000	**MidAmerica Towers, Inc. (1 TOWER)** Jay Panozzo PO Box 6556. Gainesville, GA 30504 (815) 693-1565
Citizens Telecommunications Co (1 TOWER) Elissa McOmber 250 S. Franklin Cookville, Tn. 38501 (931) 528-1584	**CCATT (1 TOWER)** Don Snyder 2000 Corporate Dr. Canonsburg, PA 15317 (724) 416-2000
Communication Enhancement (1 TOWER) Andrew Thompson 479 Centennial Blvd. Voorhees, NJ 08043 (856)782-3700	**Deleware and Hudson Railway (1 TOWER)** JR Cello 1200 Peachtree St., NE Box 123 Atlanta, Ga. 30309 (404)582-6224

Table 2 – Chenango County Cellular Towers

Municipal Wireless and Water Towers

In addition to the cellular towers there are **REMOVED FOR PUBLIC SAFETY CONCERNS** public safety towers that are owned by the County and **REMOVED FOR PUBLIC SAFFETY CONCERNS** water tower sites. Many counties are allowing fixed wireless providers space on their towers to help improve broadband coverage for their residents.

The map on the following page shows the three different types of towers – wireless, public safety, and water – as well as where they are in relation to the provider owned fiber in the County. The fiber has been identified to the extent possible. Fiber installed underground may not be pictured.

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Other Fiber

In addition to service providers there are many other entities within a community that may own and maintain fiber for their own use. Among these entities are utility companies, schools, libraries, and municipalities. The following paragraphs describe the other organizations in Chenango County that own fiber.

Village of Greene Electric Department

The Village of Greene Electric Department supplies electricity to **REMOVED DUE TO BUSINESS CONFIDENTIALITY MATERIAL** homes. **REMOVED DUE TO BUSINESS CONFIDENTIALITY MATERIAL.** They did not provide a map of their fiber for this study and have no plans to become a fiber to the home provider.

Chenango County

The County **REMOVED DUE TO CONFIDENTIAL MATERIAL**. **REMOVED DUE TO BUSINESS CONFIDENTIAL MATERIAL**. **REMOVED DUE TO BUSINESS CONFIDENTIALMATERIAL**. The County has **REMOVED DUE TO CONFIDENTIAL MATERIAL** additional buildings that are not served by fiber.

Sherburne Municipal Electric

Sherburne Municipal Electric serves the Village of Sherburne and the surrounding area. They have **REMOVED DUE TO BUSINESS CONFIDENTIALITY MATERIAL**. **REMOVED DUE TO BUSINESS CONFIDENTIALITY MATERIAL**. The map on the following page shows where they have constructed their fiber.

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Inventory Summary

Chenango County has a considerable amount of telecommunications infrastructure within the more populated areas for a typical rural county. For the most part, the business areas of the County have broadband access, but are limited in terms of providers, speeds, and potential access to diverse fiber infrastructure. The more rural areas have severely limited access. In this regard Chenango County is not unlike many other rural counties across the State and nation.

In terms of providers and competition, two incumbent local exchange carriers (ILECs), two cable TV providers, one competitive local exchange carrier (CLEC), and one fiber based provider were identified that have built infrastructure. Additionally, two Wireless Internet Service Providers and four cellular phone service providers were identified, all with limited coverage in the area west of NY State Route 12.

From an infrastructure standpoint there are 15 central offices providing service to residents and businesses. There are 18 wireless towers, with the majority of these located in proximity to developed areas and the major transportation corridors. In addition, there are miles of fiber infrastructure installed along the major transportation corridors linking towns and communities.

The study found that infrastructure supporting broadband access in the County, primarily DSL and cable Internet, is available in the populated areas and some of the rural areas. DSL based service is available to businesses and residents located close enough (within three miles) to the local incumbent telephone company central offices or remote terminals, which can extend DSL service. However, in January 2015, the FCC changed the definition of broadband to 25Mbps/3Mbps and as a result DSL service is no longer considered to be broadband. Frontier may combine fiber with their copper infrastructure to enhance the available speeds of their DSL packages.

As shown on the CATV map on page 16, Internet services provided by the cable providers are divided into two areas of the County. Time Warner Cable covers the majority of the County and has fiber and coaxial cable present. Adams Cable Services covers some of the Town of Afton.

ECC has found that the central and eastern areas of the County and the major roadways have fiber cable availability. However, there are some pockets beyond the populated areas that do not have fiber infrastructure. In areas where fiber is not available, providers are relying on more traditional infrastructures (generally copper based) to meet the demands of subscribers.

The telecommunications study found that the vast majority of existing fiber infrastructure in Chenango County is owned by the telecommunications and cable TV companies operating in the County. Since these are private organizations that have fixed capital infrastructure development plans and quarterly/yearly revenue goals, new infrastructure is constructed

primarily in the populated areas. Therefore, these organizations will place fiber in areas that can provide them with a quick return on investment (ROI), typically within two to three years. Since many of the areas in Chenango County do not fit into this ROI model, there are areas outside of the City of Norwich that are lacking.

From a Wireless Internet Service Provider standpoint, both Plexicomm and Clarity Connect have some coverage in the County and are interested in potential future expansion to meet the needs of the unserved areas of the County.

The cellular providers in the County are AT&T Wireless, Verizon Wireless, T-Mobile and Sprint. All of these cellular companies have equipment on towers strategically placed in the County to provide mobile wireless service to the maximum number of customers. Cellular coverage appears to be inconsistent throughout the County with AT&T Wireless having more coverage than the rest of the providers.

The City of Norwich has the greatest density of telecommunications services and competition in the County. Frontier, TDS, FLTG, and Time Warner Cable (Spectrum) are the major owners of telecommunications and cable TV (CATV) infrastructure respectively.

The County has good coverage in terms of utility poles. The poles that were observed in the County would require little to no make ready work to add a new fiber line. Any third party or County initiative to improve broadband service in the County would benefit from this situation.

Competition

In addition to the ILECs present in the County, reseller and extended competitive services are available from Finger Lakes Technology Group (FLTG) and ION networks, although neither company offers residential service. Plexicomm and Clarity Connect also offer competitive Internet service to a limited population of the County. Both companies provide service to the residential and commercial sectors.

Feasibility Study

Needs Assessment

During the Inventory Study, ECC met with service providers, County departments, Commerce Chenango, local businesses, and other relevant parties to obtain feedback on the need for additional broadband infrastructure. During this Assessment phase ECC has furthered these discussions as it relates to solving the existing needs of the County. The discussions included the possibility of new fiber infrastructure and wireless technologies being installed in the County and each entity's willingness to get involved in an initiative. The Assessment also includes provider competition levels and a summary of provider needs. The results of this Assessment are as follows.

Assessment Interviews/Meetings

The Fiber Needs Assessment process included identifying and meeting with potential high bandwidth users in the County to gain an understanding of the current need for improved fiber infrastructure. In addition to the high bandwidth users, key telecommunications service providers in the area were interviewed to understand their current and future infrastructure needs as it relates to expanding services in the County. The focus of the interviews was on how current needs are being met and any issues they may have with future needs.

ECC interviewed key County personnel, public entities, and private business organizations, documenting current and future Internet use.

Some of the organizations interviewed include:

- Municipal Departments: Information Technology and Planning
- Public Safety/EMS, Education
- Commerce Chenango
- Service Providers

The following is a summary of those meetings.

Municipal

The municipal organizations represented in this study included County Information Technology, GIS, and Planning. Generally speaking, municipal entities within Chenango County are experiencing the same technology and bandwidth requirement issues as other communities across the State. There is an increasing need within the State, County, Town, and Village governmental departments to share information for public health, public safety, records management, property files, etc. This is creating the need for wide area networking (WAN) environments that are capable of supporting high capacity information flows. As these applications continue to develop, collaboration between these entities are creating opportunities for efficiencies. Shared Geographical Information System (GIS) files and

centralized record keeping, among other applications, will transform the way municipal entities operate and do business.

Information Technology

ECC met with Herm Erickson from the County IT Department. **REMOVED DUE TO CONFIDENTIALITY CONCERNS.**

Public Safety

Public Safety was represented by the Sheriff, Under Sheriff and Chief Dispatcher. **REMOVED DUE TO CONFIDENTIALITY CONCERNS.**

Future fiber connectivity to the towers could support future development of high capacity mobile services that will be part of future public safety communications, including potentially the National FirstNet program. The chart below shows the differences between fiber and microwave connections.

Fiber vs. Microwave Comparison Chart		
	Fiber	**Microwave**
Transport/Media	Laser/Optic Cable	Radio/Wireless
System Capacity	Unlimited	Limited
Number of Strands	72-144	N/A
Reliability	99.999%	99.999%
Expected Useful Life	25 + years	5 to 7 years (due to limited capacity)
Expansion & Future Proof	Yes	No
Infrastructure	Aerial or underground	Radio Towers
Topology	Ring/Point-to-Point	Hot Spare (duplicate equip)
Advantages / Disadvantages	**Fiber**	**Microwave**
Pros	Infrastructure unlimited capacity available to multiple users, long life span, shared cost structures and ability to serve as a foundation for other opportunities	Convenient

Cons	Can be as much as $40,000 per mile to install	Closed Infrastructure -- limited in bandwidth and number of users/ susceptible to high wind and ice storms, must be replaced or upgraded more frequently

Table 3 – Fiber vs. Microwave Comparison Chart

Planning & Economic Development

Planning & Economic Development was represented by the Planning Director and her team, as well as the President and CEO of Commerce Chenango and his IT Specialist.

The individuals interviewed provided ECC with a list of the key employers in the County. This list was used to help determine which companies to interview for the study. The Planning & Economic Development group is interested in attracting young entrepreneurs. They realize that this demographic requires high speed and high quality bandwidth. Healthcare in the County requires broadband as most specialists are located outside the area. Most businesses in the County are either headquartered elsewhere or if headquartered within the County have critical operations outside the County, thus sharing large files (CAD, Radiology, etc.) is essential. The team from Commerce Chenango shared that it took them four hours to upload an 8-minute video over their commercial DSL connection. The group advised that Routes 12 and 8 have reasonable bandwidth but the rest of the County has minimal broadband. As a result, growth in the County is being significantly hindered by the lack of broadband.

The County has other infrastructure issues as they do not have three phase power as well as limited water, sewer, rail, four lane highways, and natural gas. Broadband could help to target businesses that can thrive without these limited resources. The team from Planning & Economic Development should be considered a strong supporter of an initiative to improve broadband access in the County.

Education

ECC spoke with Steve Andrus of Broome-Tioga BOCES. BT BOCES currently provides Internet and networking services to the school districts in Chenango County. **REMOVED DUE TO BUSINESS CONFIDENTIALITY CONCERNS.**
. Broome Tioga BOCES should be considered a low to medium level supporter of a broadband initiative within the County.

Four County Library System

The libraries in Chenango County are connected to the Four Counties Library System. The libraries are connected back to the core facility in Binghamton by **REMOVED DUE TO CONFIDENTIALITY CONCERNS.**
. The Universal Service Administration Company (USAC) is currently promoting the use of E-rate programs for schools and libraries to support the installation of dark fiber between them. This program serves to provide a static cost structure vs. the continued increasing costs of the "more you use the more you pay" model currently implemented by broadband providers. The library system would be a high supporter of a broadband initiative.

Service Providers

The service providers interviewed included the County's CLEC, FLTG, and the WISPs (Plexicomm and Clarity Connect). For these companies the availability of new fiber will

provide competition to the incumbents' infrastructure, which can very often be their only choice, thereby lowering their costs. Fiber infrastructure can allow competitive telecom providers the ability to access markets they previously could not financially justify. In addition to cheaper prices, the increase in the number of providers will equate to more choices between types of providers and advanced high bandwidth services.

Both Clarity Connect and Plexicomm expressed interest in future fiber availability. **REMOVED DUE TO CONFIDENTIALITY CONCERNS.** WISPs utilize mountain top sites, buildings, and wireless and water towers as wireless access points. To reduce costs, WISPs will look to partner with municipalities or others in the State to mount equipment on water towers and other community structures. WISPs will look at various financial models, including reduced or free access to County owned towers and tower space in exchange for services to the County. An initiative becoming popular in many regions is to allow WISPs on 911 towers owned by counties.

ECC spoke with both Plexicomm and Clarity Connect. Each company is interested in expanding their services in Chenango County. They offer both residential and business services, however Clarity Connect offers Internet services only.

Healthcare

ECC attempted to coordinate a meeting with UHS Chenango Memorial Hospital on multiple occasions but did not receive a response from them. Regrettably, we were unable to receive their feedback on broadband conditions in the County.

Local Businesses

The businesses in the County that ECC interviewed were NBT Bank, Gladding Braided Products, RealtyUSA, and Golden Artists Colors, which is the County's second largest employer after Chobani. Overall each reported that they were pleased with the quality of their service, however they would like to see lower costs and more competitive choices. **REMOVED DUE TO CONFIDENTIALITY CONCERNS**.

Infrastructure and High Bandwidth Users

The map on the following page illustrates where infrastructure exists, with businesses with revenue of over 100K (per Hoovers) overlaid. This also begins to lay the foundation to identify where additional broadband needs may exist. Included on the map are businesses, healthcare, education, government, wireless towers, and the **REMOVED DUE TO CONFIDENTIALITY CONCERNS** public safety tower locations.

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Analysis

There are a number of actions the County can take to aid in the development and expansion of new broadband services. Based on the information we collected as part of the inventory update, stakeholder meetings, infrastructure assessment, and our experience with deployment and expansion in other counties around New York State and the east coast, here is our analysis of the County's current telecommunications environment:

1. The Public Safety microwave backhaul system, although fairly new, is limited in data capacity by the nature of its technology. With the introduction of the Federal First Responder Network Authority (FirstNet) as deployed by the Nationwide Public Safety Broadband Network, it may not be adequate. Future upgrades should consider data speed upgrades, which are best supported by fiber to the tower networks.

2. The County is lacking in telecommunications competition throughout and broadband access in most of the County is limited to cable company Internet. DSL is available but the speeds offered are not considered broadband.

3. The County has significant connectivity issues between its buildings.

4. **REMOVED DUE TO CONFIDENTIALITY CONCERNS**.

5. There are unserved areas that may not be addressed by the Time Warner/Charter Communications merger in the towns of German, McDonough, Preston, Smithville, and Lincklaen. There are other potential areas that we will not know about until the merger is complete and the NY State Public Service Commission receives data from the merged company on unserved units in the merged franchise areas.

6. Many home-based businesses located in rural areas are suffering due to a lack of reliable Internet service.

7. In order to stay globally competitive, the County needs to take an active role in improving broadband services in the region.

Recommendations

Even though the Fiber Assessment has found that there is a significant amount of cable fiber infrastructure in the County, there are pockets of areas that are lacking in fiber. The areas with the most need are German, McDonough, Preston, Smithville and Lincklaen. In addition, we have found through our interviews with many organizations in the County that the addition of more fiber and broadband services will provide benefit across the County in many ways. The fiber will enable the expansion of broadband, which will increase property values, increase competition, diversity, economic development, efficiencies in government and quality of life. With traditional telecom providers subscribing to return on investment (ROI) models of three years or less, it has become difficult to justify broadband development in some of the more remote areas of the County.

Based on this, our recommendation is for the County to build a "collaborative" whose goal would be to develop infrastructure that could be used to support government, education, healthcare, economic development and broadband expansion to unserved areas of the County. The development of such a collaborative would take 2-3 years. Although some of the entities interviewed were not in strong support of a short term broadband initiative, it should be considered for the long-term vitality of the County.

Several factors are in play for the County and such partnering entities to consider. Collaboration and build out with respect to public safety may open the County up to additional grant funds. USAC and the E-rate program are advocating and financially supporting the build out of fiber infrastructure in rural areas to support schools and libraries. Linking towns, villages and other municipal entities increases efficiencies and creates a foundation to support economic development and broadband expansion, to name a few.

If the County chooses to build fiber infrastructure to connect their public safety towers and government buildings together, a grant application either to the USDA or to the Broadband for All program could help mitigate some of the costs of the fiber build. Additional fiber should be constructed to connect the area schools and libraries. E-rate funding could be used to support this portion of the build.

The public safety upgrade that the County installed a few years ago, can be further enhanced with the capability of fiber. In addition, with FirstNet on the horizon (which will demand high levels of backbone bandwidth) available fiber infrastructure will be an important asset for the County to use going forward.

Partnering with a local WISP (Plexicomm for example) and allowing them to place equipment on public safety towers in areas that are unserved based on the new broadband program guidelines will further enhance broadband coverage. **REMOVED DUE TO CONFIDENTIALITY CONCERNS.**

Commercial mobile wireless (cellular) and fixed wireless (WISP) broadband go hand in hand with fiber based broadband. A cost-effective method of providing last mile broadband to generally less affluent unserved and underserved areas of a County is through fixed wireless broadband connected to and along a fiber backbone. The preferred (and in some cases required) backhaul technology for wireless broadband is fiber optics because of the aggregated demand for greater bandwidth. A partnership between the County, a WISP, and a fiber backbone provider would expand service into needy areas. If the County pursues a WISP partnership, a Wireless Propagation Study targeting areas in the County is a necessity.

County Owned Fiber

This section of the report explores the viability of the County building dark fiber to connect select public entity locations in the County. The cost of this infrastructure would be partially financed by the cost avoidance of expenditures that County organizations are currently making to commercial telecommunication companies.

It is recommended that the County fiber optic network be routed in the most efficient and economical manner. Whenever possible, the County should build, lease, and operate the fiber optic backbone in partnership with existing utilities.

The preliminary routing of the fiber optic backbone would be selected based on several factors:

1. Connecting the County public safety towers together.
2. Connecting the County schools and libraries together.
3. The ability to reach the largest number of community facilities and to serve the greatest need.
4. Support educational, healthcare, municipal, and economic development programs.
5. Build and maintenance costs.

It is recommended that Chenango County install the fiber optic cabling on existing utility poles wherever possible. Although underground installation would be desirable, the high costs associated with underground construction would challenge the financial feasibility of building the network.

Users of the Fiber Optic Network

The Chenango County business model will seek to serve two primary customer types: public safety organizations and public facilities.

1. Public safety – These include police, sheriff, fire and EMS, as well as back up for the Public Safety radio network.

2. Public facilities – These include municipal office buildings, public libraries, and others.

If after the fiber is built there is excess capacity available and the County is inclined to allow private providers access to the fiber, the fiber backbone could be used to establish a collaborative telecommunications foundation with providers. This capacity is intentionally excluded for the express purpose of being used for non-governmental functions, as it is not the ultimate goal of the potential fiber build, but could be used to allow commercial service providers, including Competitive Local Exchange Carriers (CLECs) and WISPs, to develop and provide services on an equitable and cost effective basis to unserved and underserved areas of the County. In addition, commercial providers may seek to lease fiber from the

County to extend their private enterprise networks. Leasing fiber to private industry will help defray the costs incurred by building and running a fiber optic network.

Fiber Routing

The proposed fiber backbone routes to connect the Public Safety towers together starts in Greene and runs along Route 12. Fiber spurs run off of the main artery to connect to the public safety towers and other locations. A map of the proposed fiber can be found on page 38. Costs to build the network are detailed below.

Anticipated Preliminary Cost to Build

Below are the estimated costs to build fiber only between the public safety towers.

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It is expected the development combined with the design and construction of the fiber optic backbone will take up to 24 months to complete. If approval to proceed is provided by January of 2017, the expected completion date of the fiber would be January 2019. The project design and construction schedule has been selected to allow for the development of contiguous fiber optic paths wherever possible. This method allows the Chenango County team the ability to use fiber for internal purposes.

The proposed budget for the building of the full fiber optic backbone is roughly **REMOVED DUE TO CONFIDENTIALITY CONCERNS**, which includes a 7.5% contingency. Capital (build) costs are expected to be covered by grants. The estimated annual operations, maintenance costs, and additional details will be provided in the financial section of the Preliminary Business Plan. See page 41 for a detailed breakdown of the budget. **REMOVED DUE TO CONFIDENTIALITY CONCERNS**

Available Grant and Loan Programs

The County has some options to potentially help defray the cost of building a fiber optic backbone to its underserved and unserved areas. The pursuit of broadband grant opportunities for rural area broadband access, such as those periodically provided by the USDA or Golden Leaf, is encouraged. Applying for federal, state, and local grants that help rural areas assist providers in infrastructure development is another avenue to pursue. The USDA Rural Utility Service has yearly telecommunications-based grant programs to aid in the development of underserved areas of the Country. These types of funding opportunities are often overlooked but can be very helpful in spurring local efforts. The chart below lists a number of grants and loans Chenango County could apply to for funding to help with broadband expansion to the unserved/underserved population. The USDA Rural Utility Service grant can be accessed here:

http://www.rurdev.usda.gov/RUSTelecomPrograms.html

Organization	Program Name	Program Summary
USAC	E-rate	Beginning FY 2016, program support will be available for construction of high-speed broadband networks. The costs of dark fiber construction have also been extended to eligibility beyond the property line.
RUS	Telecommunications Infrastructure Loans & Loan Guarantees	Financing for construction, maintenance &, expansion of service in rural areas with a population of 5,000 or less. Applications accepted through local RUS office year round.
RUS	Community Connect Grant	Helps with broadband deployment in rural areas that lack existing broadband speeds of 4 mbps by 1 mbps. Application deadline for 2016 is June 17th.
RUS	Farm Bill Broadband Loans & Loan Guarantees	15% of households in area must be unserved and the entire area must be considered rural. Application window for 2016 is April 8th – July 7th.
ESD BPO	Broadband for All	Governor Cuomo's initiative to have broadband across NYS by 2018. The program has $500 million with a 50% match. Phase 1 application deadline was April 15th, 2016. Phase II has not yet been announced.

Governor Cuomo has created a new broadband grant program in the state which could incentivize providers to expand and help in improving competition and lowering costs. The New NY Broadband Program identifies 1,806 housing units that are unserved and 54

housing units underserved. These are located in the towns of German, McDonough, Preston, Smithville and Lincklaen. These areas are not within the Time Warner/Charter Communications merger area as determined by NY State.

The map on the following page shows the areas that are considered unserved and underserved by NYS for the purpose of their current broadband grant guidelines.
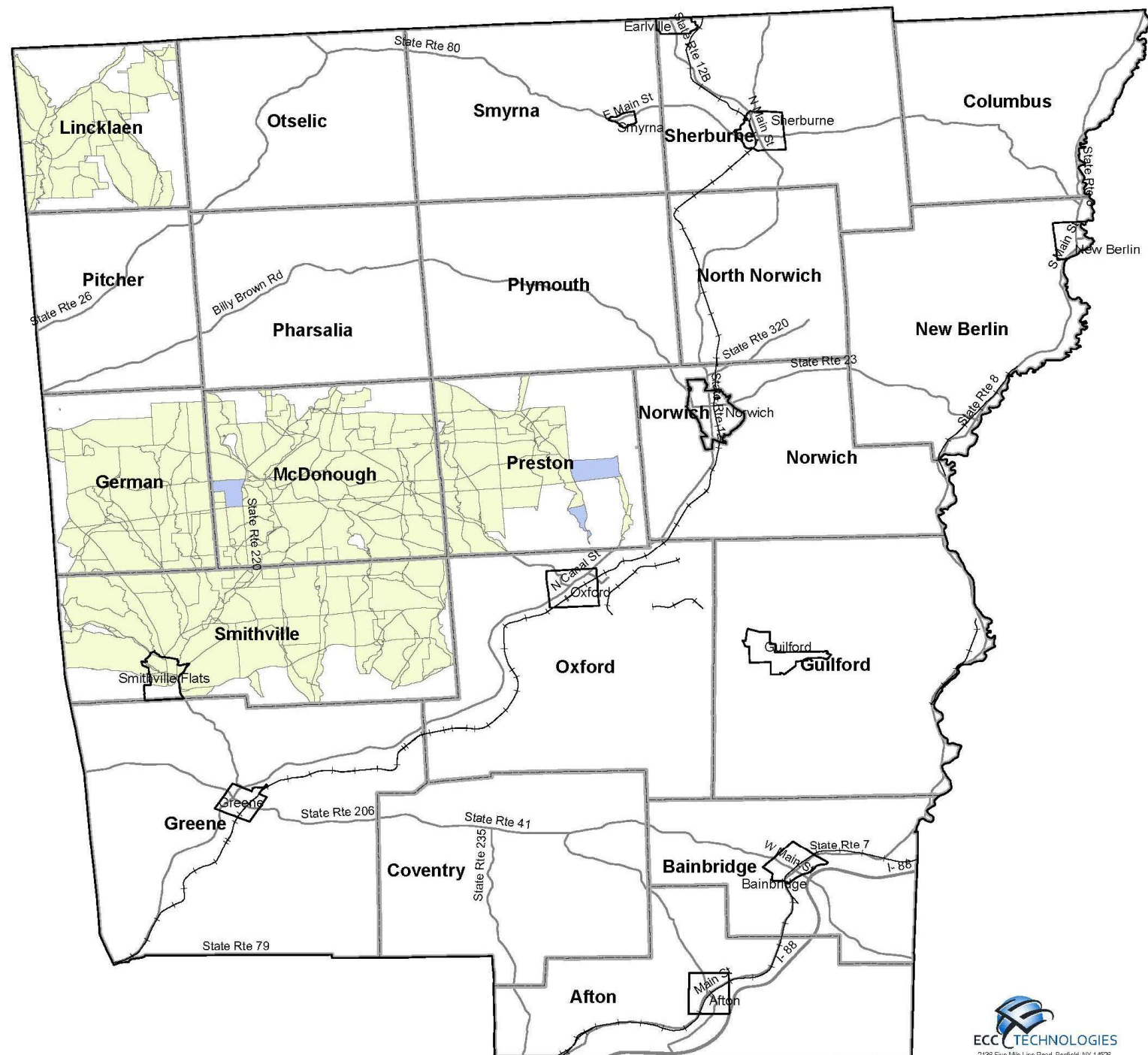
CHENANGO COUNTY, NY
UNSERVED + UNDERSERVED REGIONS
Date: 4/28/2016

Legend

UNserved Regions

UNDERserved Regions

0   1.5   3   6   9   12
Miles

THIS MAP IS CONSIDERED CONFIDENTIAL INFORMATION AND SHOULD NOT BE COPIED OR DISTRIBUTED

Public/Private Partnerships

Partner with Local Fiber Based Provider

A second option for the County would be to partner with regional fiber network owners to accomplish the build out of fiber into areas where the greatest needs exist. This alternative would establish the County as a willing partner with fiber providers to install and operate fiber focused on linking educational and municipal facilities, public safety, desired tower locations, and Economic Development Sites County-wide.

Following the same type of plan as identified above for a municipal build with variations to include the entire County, the County can collaborate with partners to develop new fiber infrastructure. However, in this scenario the owner of the fiber — the service provider — generally does not "open" their cable for other providers to use. This limits the overall impact the fiber will have in terms of increasing competition.

The County can support this build out through a number of various methods:

1. Seek and communicate intentions with willing fiber partners, including but not limited to Fingerlakes Technology Group or Plexicomm.

2. Support the development of grant applications from various sources, namely the USDA, FCC, and NYS Broadband.

3. Commit cost avoidance funds in exchange for long term contracts for dark fiber linking County facilities, including public safety towers.

4. Provide access to Rights of Way to expedite the build out of the fiber.

5. Provide input into the routing to accommodate fiber availability to desired economic development locations.

6. Secure additional partners such as the schools, colleges, healthcare, Wireless Internet Service Providers, and others for collaboration

The user needs and financial data provided in the County owned approach is valid for the partnership approach as well. Once a fiber partner is identified these numbers will need to be revisited based on the actual experiences of the partner.

Action Steps

If the County makes the decision to own telecommunications infrastructure they should consider the following actions:

Designate a Champion

As a first step, it is imperative that a person within the County be chosen as a "champion" to oversee and provide the necessary "will" to move the initiative forward. Ideally, the champion will possess political weight in the community, some technical experience, and the time needed to devote to such an effort. This person will be in charge of many things,

including overseeing the project, designating tasks and responsibilities, developing the business structure, and day to day activities associated with the development of initiative.

Steering Committee

Create a small three-to-four-member steering committee to move the fiber initiative forward. The members should include County IT, a County Executive team member, and the telecom champion. This working group should be chartered with providing strategic planning and setting policy for the development of the fiber initiative.

Conclusion

The Fiber Needs Assessment suggests that the needs of communications carriers for advanced, high bandwidth voice, data, and video transmission capacity will increase over the next several years due to various factors. The ongoing desire to expand broadband access as well as the development of high bandwidth applications supporting healthcare, public safety, education, business, and municipal needs will increase the dependency on the fiber optic backbone. The listed benefits of community fiber from the Broadband Feasibility Study include enhanced broadband access, service redundancy, improved competition, and future-proof technology. Additionally, the public safety system that the County is currently using can be further enhanced with better connectivity; and with FirstNet on the horizon (which will demand high levels of backbone bandwidth), fiber infrastructure will be an important and necessary asset for the County to use going forward.

There may be interest from the broadband service provider community to pursue a partnership with the County to develop opportunities for fiber expansion by particular providers. The Fiber Needs Assessment also suggests that the telecommunications industry will have a desire to provide increased services including, but not limited to, expanding broadband into the more rural and underserved areas of the County. In addition, the telecommunications industry will need additional fiber to support any advancements in wireless deployment, or the FirstNet rollout for public safety. At this time the cost for the mobile telecommunications industry to build to these locations is prohibitive, as we noted earlier based on expected ROI.

Along the central region of Chenango County businesses and others generally have the benefit of being able to choose between multiple providers for various telecom services, mostly moderate to low grade in nature. However, outside these more populous areas of the County there is a significantly diminishing amount of broadband availability with numerous pockets of unserved and underserved locations. By forming partnerships to expand fiber coverage and by working with the wireless providers to gain access to strategically located water and radio towers, the County has the potential to enhance and expedite the development of broadband and increase the quality of life and desirability of the region to newcomers, both individual and commercial.

At the crux of the quality of life experience is the access to technology, information, and communications. The world is quickly urbanizing. Every week, more than 1 million people move into cities across the world. At the end of 2015, more than half (54%) of the world's population lived in cities, according to the CIA Factbook, following a 2% increase in the urban population each year between 2010 and 2015. People are migrating to highly diversified cities while abandoning suburban and rural areas, which rely heavily on now declining industries.

Given that resources and funding are elusive for many industries as well as state, county, and local governments, a shared or partnering approach is required by all stakeholders. Although a shared or cooperative/joint effort is difficult to validate and be agreed to by all stakeholders,

there is a real and tangible payback for the County and/or municipalities that is measurable and definitive.

As the world becomes more and more complicated and diverse, mayors, county executives, governors, and municipalities are striving to make their communities "smarter." In theory, at least, broadband access can keep traffic moving, detect and prevent crime, monitor the condition of roads, lighting, parks and other infrastructure, and efficiently allocate public resources, all with the express goal of increasing the quality of life and contributing to economic stability in each community.

In the "Recommendations" section we touched upon the importance of fiber optics in a community, which includes:

1) Its ability to improve virtually all aspects of a community ranging from efficiencies in:

   a) current government and public safety;

   b) job creation;

   c) improving education and healthcare; and

   d) providing broadband access to residents and businesses

2) Being one of the primary attractions to justifying increased investment by mobile operators in the County's cellular communications delivery.

3) Providing the fiber backbone for FirstNet, as well as the foundation for the radio communications required.

4) Increasing the quality of life for residents, thereby increasing the property base values.

The last aspect is one of the most significant areas the County can improve by increasing access to broadband in underserved and unserved areas.

High-speed fiber broadband service, with 1 Gbps download speeds, can add more than $5,400 to the value of an average U.S. home, according to a study commissioned by the Fiber to the Home Council Americas (FTTH), an advocacy group made up of fiber equipment vendors and broadband providers. That $5,400 figure is approximately equal to adding a new fireplace, half of a new bathroom, or a quarter of a swimming pool, according to the study conducted by researchers at the University of Colorado at Boulder and Carnegie Mellon University.

Speed matters, the study found. For homes where 1 Gbps broadband was available, sale prices were 7 percent higher than for homes in areas with broadband speeds of 25 Mbps or lower. In 2014, FTTH released a study finding higher per capita gross domestic product in communities where gigabit Internet was available.

The study used home sales data from 2011 to 2013, U.S. Census Data, and the U.S. Federal Communications Commission's 2012 and 2013 national broadband maps to investigate the

relationship between broadband availability and home prices. The study looked at about a half million home sales during that time frame. The results were that:

1) Access to fiber in a neighborhood raises the property value by 1.3%.

2) Being able to access speeds up to 1 gigabit (1 Gb) boosts the value another 1.8%.

The Chenango County assessed property value through 2105 was roughly, $1,470,000,000 at an average rate of .024 for county tax alone. Let us assume the County of just bringing fiber access to neighborhoods as a reasonable goal, without actually partnering with service providers to get services to the home or business. This access or capability alone could result in a tax benefit for the County of approximately $ 460,000/year.

Therefore, a shared contribution or investment of $2,300,000 by the County, with the remaining funds coming from grants, would have a ROI of five years for the County's portion. This does not account for the royalties, access fees, or residuals for leasing the fiber to FirstNet, the mobile access providers, WISPs or other broadband carriers.

In closing, we hope Chenango County sees through the findings of this study, both the situation the County is currently in and the great potential and opportunity that the County is on the cusp of. The potential is within reach for a reasonable investment that can also providing strength to the economic engine of the County and enhance the quality of life for all the residents and businesses that comprise the population.

Appendix: Glossary of Terms*

* All terms and definitions listed in this Glossary of Terms originated from various public resources.

ATM (Asynchronous Transfer Mode)

ATM is a high-speed, low-delay transmission method. ATM uses fixed length cellular (chunks) to transfer voice, data, and video over twisted pair and optical fiber. ATM can be configured to allocate bandwidth appropriately to meet the needs of both time sensitive and non-time sensitive applications. ATM permits flexible allocation of available bandwidth for data, voice, images, and video. ATM uses a scalable architecture, making it easily upgradeable. Engineering studies indicated that ATM is capable of data rates of 622Mbps over fiber optic cable (SMF and MMF) and 155Mbps over Category 5 UTP copper.

BACKBONE

Backbone, in the context of networking, refers to the highest speed and widest bandwidth point of a communications circuit or path. In most cases, all information central to the users is connected to the backbone (e.g., shared databases or servers).

BANDWIDTH

Bandwidth is the amount of data that can be carried by a circuit between two points of a network. Bandwidth is typically measured in Hertz (cycles per second), bits per second or kilobits per second (shortened to Bps or Kbps). The top speed of today's modems is 56,000Bps or 56Kbps. The wire connecting a private home to the telephone company carries up to 128,000Bps while one strand of fiber optics can carry 20,000,000,000 (20 Gigabits). A 20Gbps fiber optic strand can interconnect 357,000 telephone calls.

BROADBAND

Broadband is a descriptive term for evolving digital technologies that provide consumers a signal switched facility offering integrated access to voice, high-speed data service, video-demand services, and interactive delivery services.

CATV (Cable Television System)

A broadband communications system capable of delivering multiple channels of programming from a set of centralized satellite and off-air antennae, generally by coaxial cable, to a community. Many cable-television designs integrate fiber-optic and microwave links.

CATV (Community Antenna Television)

A service through which subscribers pay to have local television stations and additional programs brought into their homes from an antenna via a coaxial cable.

CARRIER

A telecommunications company that offers communication services to the general public via shared circuits at published tariff rates. In the United States, the Federal Communications Commission and various state public-utility commissions regulate common carriers.

CELLULAR TECHNOLOGY

This term, often used for all wireless phones regardless of the technology they use, derives from cellular base stations that receive and transmit calls. Both cellular and PCS phones use cellular technology.

CENTRAL OFFICE (CO)

A CO is a major equipment center designed to serve the communications traffic of a specific geographic area. CO coordinates are used in mileage calculations for local and interexchange service rates. A Central Office usually has less than 100,000 telephone lines within its wire boundary. COs are usually owned and operated by LECs.

CLEC (Competitive Local Exchange Carrier)

A CLEC is a telephone company that competes with the incumbent telephone company. The formation of these organizations is a direct result of the Telecommunications Act of 1996.

COAXIAL CABLE

A type of cable used for broadband data and cable systems. Also known as "coax." Coaxial cable is composed of an insulated central conducting wire wrapped in another cylindrical conducting wire. It is usually wrapped in another layer and an outer protective layer and has the capacity to carry great quantities of information.

DARK FIBER

Dark Fiber is fiber optic cable, typically between end user locations, that the end user owns, lights and operates.

DIGITAL

A function that operates in discrete steps as contrasted with a continuous, or analog, function. Digital computers manipulate numbers encoded in binary (on-off) forms, while analog computers sum continuously varying forms. Digital communications is the transmission of information using discontinuous, discrete electrical or electromagnetic signals that change in frequency, polarity, or amplitude. Analog forms may be encoded for transmission on digital communications systems.

DIGITAL DIVIDE

The availability of service between the areas that have access to advanced broadband services and those that do not.

DS-0

DS-0 (see also 56Kbps) is the bandwidth required for one voice conversation. It is 64Kbps and is one of 24 channels in a DS-1, or T1.

DSL (Digital Subscriber Line)

DSL is new technology that allows for the simultaneous transmission of voice and Internet data over a single telephone line. Central Offices that have DSL technology can support DSL services to customers within approximately 18,000 feet of the Central Office.

DSL is delivered either asymmetrically (ADSL) or symmetrically (SDSL). ADSL lines have download transmission rates higher than upload rates and are typical for residential or business users that receive much more Internet content than they send. SDSL are for businesses that generate and receive large amounts of Internet data.

FIBER OPTICS

The technology of guiding and projecting light for use as a communications medium. Hair- thin glass fibers that allow light beams to be bent and reflected with low levels of loss and interference are known as "glass optical wave guides" or simply "optical fibers." This cable comes in two types, single mode and multimode, each with its own unique place in communications. Single mode FO cable is typically used where long distances and very high speeds are required, while multimode is used for intra-building communications and places where lower bandwidths are required.

FIBER-OPTIC CABLE

A cable containing one or more optical fibers.

HEADEND

The control center of a cable-television system, where incoming signals are amplified, converted, processed, and combined into a common cable for transmission to subscribers.

INCUMBENT LOCAL EXCHANGE CARRIER (ILEC)

An ILEC is the local telephone company that provides service to business, organizations and residence within the LATA. The ILEC is responsible for the development, maintenance and support of cabling infrastructure necessary to provide telecommunications services within the LATA.

INTERNET

A widely used public computer network, initially developed by the U.S. military that links smaller computer networks and allows users on different electronic-mail systems to communicate with one another on a global scale.

INTERNET PROTOCOL (IP)

In TCP/IP, a connection Internet layer protocol that provides a best-efforts datagram delivery service. Note the functional layer (TCP/IP) corresponds to the OSI model network layer. The Internet layer provides routing and relaying functions that are used when data must be passed from a host to some other network in the Internet. It operates in the source and destination hosts and in all the routers along the path between the hosts.

ISP (Internet Service Provider)

A company that provides access to the Internet to individuals or companies. Some ISPs lease connections from Internet backbone providers.

LANDLINE

Traditional wired phone service.

LAST-MILE

Last Mile is used to describe the final connection to a building, as differentiated from the high capacity circuits extending across a city or County. The connection from the cable television trunk cable to your house is considered a "last-mile" connection.

LOCAL EXCHANGE CARRIER (LEC)

A LEC is a telephone company or Telco that offers local and long distance telephone service within a defined region referred to as the LATA— Local Access & Transport Area. A LATA or is the regional calling area within which the incumbent local telephone company provides local and long distance services. Service to points outside the LATA is provided by long distance carriers.

NETWORK

Any connection of two or more computers that enables them to communicate. Networks may include transmission devices, servers, cables, routers and satellites. The phone network is the total infrastructure for transmitting phone messages.

POTS (Plain Old Telephone System)

POTS refers to an un-enhanced telephone service with the ability to send and receive phone calls. Features like call-waiting and call-forward are available.

RF (Radio Frequency)

RF refers to the electromagnetic waves operating between 10KHz and 3MHz propagated without guide (wire or cable) in free space.

RIGHT-OF-WAY

ROW refers to a designated space alongside a street or other access (such as a railroad line). An entity wishing to install fiber optic cable between various sites/locations must first obtain the rights to a path along those routes. As the cable may be installed underground or on poles, right-of-way access may be granted by a city, a private landowner or the owner of poles such a cable company, a telephone company or power company. Cities typically require written permits— usually for a fee.

SERVICE PROVIDER

A telecommunications provider that owns circuit switching equipment.

SONET (Synchronous Optical NETwork)

SONET is an optical network used to transport many unique digital signals (ATM, T-1, etc.) over the same optical carrier. Its physical interface is the OC (Optical Carrier), which has a base rate of OC-1 (or 51.84Mbps), and continues to as high as the theoretical limit of 13Gbps; however, OC-48 (2.5Gbps) is the current limit.

SUPER-FI BROADBAND

Super-Fi broadband, also known as white space broadband, refers to the unused broadcasting frequencies in the wireless spectrum. Television networks leave gaps between channels for buffering purposes, and this space in the wireless spectrum is similar to what is used for 4G and so it can be used to deliver widespread broadband Internet.

T1 (DS-1)

The T1 standard has a speed of 1.544Mbps in the United States. The T1 standard has carried over to data networking from the voice arena where it was used to describe a carrier that could carry 24 voice conversations over a clear channel (64Kbps, DS-0).

T1 LINE

Telecommunications line with bandwidth capacity of 1.54Mbps.

T3 LINE

Telecommunications line with bandwidth capacity of 45 Mbps.

WAN (Wide Area Network)

WAN is used to extend LAN connectivity beyond a city or County, usually through common carrier facilities.

WHITE SPACE

White space broadband, also known as Super-Fi, refers to the unused broadcasting frequencies in the wireless spectrum. Television networks leave gaps between channels for buffering purposes, and this space in the wireless spectrum is similar to what is used for 4G and so it can be used to deliver widespread broadband Internet.

WIRELESS

Wireless describes a means of sending signals (voice, video or data) "over the air" rather than using cables. To date, wireless bandwidth rates (capacities) are significantly lower than wire rates. There are significant new developments in wireless, many of which will come to market in 2014 and beyond.