Expanding Broadband Access Plan

Prepared for Tompkins County, NY

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Statement of Confidentiality

ECC Technologies

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1. Executive Summary

This plan aims to address local challenges by identifying broadband infrastructure and unserved addresses throughout Tompkins County. The project focuses on expanding internet service providers (ISP) infrastructure to addresses that are unserved. Tompkins County has initiated a broadband project to identify businesses and households that do not have access to fiber or coaxial broadband services. The County's goal is to formulate a solution that expands high-speed broadband access, defined as 100 Megabytes per second (Mbps) upload and download speeds, to all addresses in Tompkins County.

Broadband Access

Broadband access needs to be reliable and affordable high-speed internet, as well as symmetrical to meet both today and tomorrow's needs. Some current technology, including coaxial cable, is not capable of providing symmetrical speeds. While coaxial cable is moving toward this capability, Tompkins County would like to ensure that symmetrical speeds are offered countywide. This type of network is intended to serve a diverse set of needs, including agricultural production, higher education, medical services, and manufacturing, among other lines of business. It can also act as a catalyst for rural prosperity by enabling efficient, modern communications between rural U.S. households, schools, and healthcare centers as well as markets and customers around the world.

The Plan

The plan focuses on two main components:

- Identifying where infrastructure is in place for coaxial or fiber optic cables throughout the county and positioning the network to provide opportunities for growth, expansion, or improvements in efficiency.
- Assessing opportunities for unserved businesses and households, with a focus on enhancing these areas to provide 100% broadband capability to everyone in the county.

Data Collection

The County used data from New York State Department of Public Service (NYS DPS), Federal Communications Commission (FCC), field surveys of broadband infrastructure that were completed on behalf of local municipalities and shared with the County, and ECC Technologies' (ECC) physical verification of infrastructure mapping to accurately provide a snapshot of the current network provided by each internet provider doing business in the county. This data, compiled in the Spring of 2023, was used to devise solutions to expand the network to serve the remaining unserved addresses within Tompkins County.

Broadband Availability & Adoption Tool

Additionally, as part of this study, ECC worked with Tompkins County to establish a Broadband Availability & Adoption Tool (BAAT); a web-based application that allowed documentation of demand for broadband services within Tompkins County. The BAAT included a marketing component, as well

as a data collection and mapping component. All responses were captured within the one BAAT portal. The data collected through the BAAT assisted ECC and the County in identifying areas with a lack of broadband access, as well as to more easily identify partners to address these issues.

The BAAT provided the following:

- Receipt of 1,014 responses from across the County
- Key findings:
    - 17% of respondents did not have access to broadband – higher than the NYS average
    - 28% of respondents could not purchase the speed they required, with an additional 13% indicating that they do not know
    - 15% of respondents indicated they would pay up to $10 more per month, and an additional 33% would pay up to $30 more per month for improved service
    - Over 67% of respondents indicated that they use broadband / internet service for both doctor's visits and working from home
    - 96% indicated that internet service was essential
    - Over 85% of respondents indicated that it is important or very important to have a choice in providers
- Understanding the sentiment of County residents and businesses was influential in the development of solutions for Tompkins County

Infrastructure Inventory

ECC created a comprehensive inventory of broadband infrastructure in the county. They gathered data from the County; the Towns of Danby, Lansing, and Newfield; internet service providers and conducted a spot check of existing infrastructure, including fiber optic, coaxial cable, and towers. ECC used this data to create maps of the county's infrastructure in an ESRI GIS database. ECC's Outside Plant team then physically verified the data by driving a sample of the roads in the county.

This inventory is the latest and most accurate available data on broadband infrastructure in the county. It will be used to help improve broadband access and adoption in the county.

The data and accompanying maps that were created not only show where fiber-based broadband exists today, but also provide insight into areas that need additional infrastructure for the expansion of broadband services. Critical broadband access/telecommunications infrastructure information is included in this report that can lay the foundation for broadband improvement plans.

The information compiled by ECC Technologies is presented in the following pages of this report. Much of this information has also been placed into an interactive electronic GIS database and provided to Tompkins County.

Finding of Need

Through this data collection and analysis, ECC has identified:

- 121 miles of new infrastructure that would be required to provide broadband service to

- 1,216 unserved addresses and businesses located in Tompkins County

The estimated budget for implementing Option 1 outlined in this Plan is $7.3M, based upon an estimated $60,000/mile to construct fiber optic infrastructure along these roads, along with associated distribution and electronics.

The miles and unserved addresses are depicted in figure 1 below. The green dots represent each unserved address, and the red lines represent the approximate length that an existing broadband network would need to be extended in order to serve those addresses.

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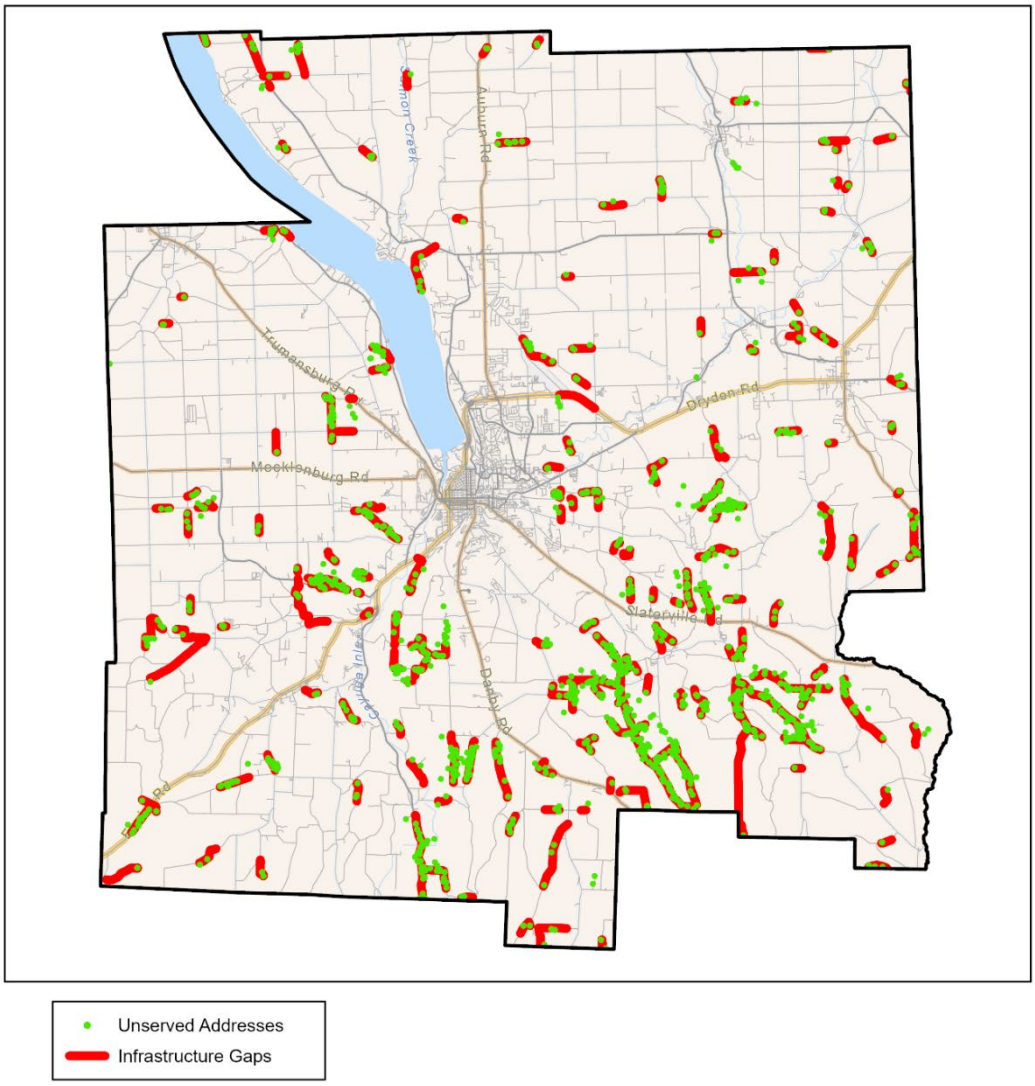

FIGURE 1: TOMPKINS COUNTY INFRASTRUCTURE GAPS AND UNSERVED ADDRESSES (AS OF SPRING 2023)

Options

This Plan presents several options for achieving broadband availability countywide. These are:

- Option 1: Request for proposals (RFP) to Existing and New Broadband Providers
- Option 2: Direct Negotiations with Broadband Providers
- Option 3: Public/Private Partnership
- Option 4: Open Access Model (Middle Mile)
- Option 5: County-Owned Fiber to the Home Broadband Network

The County considered the pros and cons of each of the options and determined that Option 1, releasing an RFP for Existing and New Broadband Providers, would be the preferred initial course of action. This approach was thought to be a preferred first step to achieve the goals of the project in an expedient and cost-effective way, that would also result in enhancing collaboration between broadband providers, community partners, and the County to resolve the access issues. The following page contains a chart outlining all of the options mentioned above.

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TABLE 2: TOMPKINS COUNTY OPTIONS FOR BROADBAND EXPANSION

Option	Estimated Cost	Timing	Pros	Cons
1 RFP	$7 Million	3 to 5 Years	100% unserved addresses receive broadband service - potential competitive choice/provider - Ownership of Infrastructure by provider(s) - Negotiate Indefeasible Right of Use for fiber access to support municipal needs	County may contribute taxpayer dollars without a way to recover - Awardee may be dominant provider - No Competitive Choice for providers - Limited recourse if provider provides poor service
2 Direct Negotiations	$7 Million	3 to 5 Years	100% Unserved Addresses receive broadband service - Ownership of Infrastructure by provider(s) - Negotiate Indefeasible Right of Use	County may contribute taxpayer dollars without a way to recover - Awardee may be dominant provider - No Competitive Choice for providers - Limited recourse if provider provides poor service
3 Public/Private Partnership	$21 Million	5 Years	100% Unserved Addresses receive broadband service - Potential Competitive Choice/Provider - County Owns Infrastructure - Revenue Generation - Recover Taxpayer Money over time	County needs to identify capital funding or Grant Match - RUS/USDA Grants are onerous to apply for - Direct County Assistance
4 Open Access	$14 Million	5 Years	Competitive Choice - Ownership of Infrastructure by County/LDC - Revenue Generation	Option may not solve unserved address - County needs funding for construction - LDC owns infrastructure and has the option of selecting partners to operate it
5 County-owned	$95-100 Million (est.)	7+ Years	Creates competition countywide and allows the County to control services available for the foreseeable future. Solves issues with respect to served vs unserved and future builds to properties not yet developed	Considerable price tag to overbuild services that are already available in many areas. Requires the County or partners to increase staff significantly and ties the County to a long-term debt and operations expense. Devalues current investments in Broadband in the County and will be challenging to achieve a suitable take rate to recover costs. Maximum take rate expected to be 50-60% over time.

2. Background and Context

Broadband Types

This section introduces the major providers and infrastructure types used in Tompkins County to deliver broadband service. The current broadband providers in the county deliver service to homes, businesses, and other organizations at varying degrees of access, performance, and cost. The technologies in use by industry today include a) wirelines consisting of copper, coaxial, or fiber, and b) wireless-based technology that utilize strategically placed towers and satellites. Table 2, below, lists each technology type and the maximum internet speeds for each technology type.

TABLE 2: INTERNET SPEEDS BY TECHNOLOGY TYPE

Technology Type	Internet Speeds
Digital Subscriber Line	25 Mbps/3 Mbps
Very High-Speed Digital Subscriber Line	55 Mbps/3 Mbps (up to 300/100 Mbps)
Hybrid Fiber Optical Coaxial	1.2 Gbps/50 Mbps
Fiber Optic	20 Gbps/20 Gbps
4G Cellular	300 Mbps/5 Mbps
Low-band 5G Cellular	250 Mbps/35 Mbps
High-band mmWave 5G Cellular	3 Gbps/1 Gbps
5G Cellular	20 Gbps/10 Gbps
Fixed Wireless	1 Gbps/1 Mbps
Satellite	100 Mbps/3 Mbps

WIRELINE IS IN BLUE

WIRELESS IS IN GRAY

Wireline Infrastructure

Wireline infrastructure includes telephone and cable TV coaxial cables, which are either buried in the ground or attached aerially to utility poles. Wireline cables can be twisted pairs of copper wire, coaxial, or fiber optic cable. The wireline infrastructure serving Tompkins County is primarily owned and operated by incumbent local exchange carriers, cable providers, and power utilities.

Digital Subscriber Line (DSL)

Copper cable is still the most common infrastructure serving homes and businesses across the county. It is used by telephone companies to connect central offices to end users for the purpose of providing traditional voice and data services. While typically referred to as broadband, this is actually a Digital Subscriber Line. Copper cable has an extremely limited capacity for providing today's expected high-speed broadband service and is usually the reason advanced telecommunications services are not available in certain areas. The limitation of providing broadband access over copper is a direct result of distance from the Central Office or remote terminal, the age, and the poor performance qualities inherent to the wire itself.

Most residential telephone service in Tompkins County is supplied by this copper cable that consists of numerous pairs of unconditioned twisted pair (UTP) copper wires. To provide a faster service over existing copper lines, the telephone carriers have developed digital services called DSL, or "digital subscriber line" technology, which is considered a low-cost form of broadband. DSL uses an ordinary UTP drop to deliver bandwidth services typically up to 10 megabits per second (Mbps) service.

Depending on the type of DSL topology and equipment used, speeds up to 100 Mbps can be reached over noticeably short distances or very high-speed digital subscriber lines (VDSL), often under a distance from equipment to subscriber of 3,280 feet (0.6 miles).

Since its introduction into the telecommunications industry, DSL has become an immensely popular service for the incumbents because it requires only the addition of new end equipment and not the replacement of cable, which is very expensive. A drawback of the technology, however, is that it requires that customers be within three cable miles of the DSL equipment, and even that is no guarantee of service.

CATV Coaxial Cable

Cable TV (CATV) providers, such as Spectrum and Haefele Connect, use a hybrid fiber optic/coaxial (HFC) cable network to provide high-quality video, high-speed data, and voice services to their customers. In most cases the fiber provides a connection from the signal origination, referred to as the headend, to a node where an optical to electrical signal conversion is made. Then coaxial cable connects the node to the customer site. The high-performance characteristic of coaxial cable supports the transmission of telephone, video, and data. The CATV provider utilizes cable modem technology, which uses a single coaxial cable TV connection to a customer location to support the simultaneous transmission of voice, TV programing, and internet. In Tompkins County broadband access is available in most areas via this HFC infrastructure installed by the incumbent cable TV provider.

Fiber Optic Cable

Fiber optic cables are used to transmit information over long distances at high speeds. They are made of thin strands of glass or plastic about the diameter of a strand of human hair, that transmit light. The light is encoded with information, such as data or video. When the light reaches the end of the fiber, it is decoded, and the information is retrieved.

Fiber optic cables can transmit more data over longer distances than other mediums, such as copper cables. Fiber optic cables are also immune to electromagnetic interference, which can disrupt the transmission of data over copper cables.

A fiber optic cable contains anywhere from a few to hundreds of optical fibers within a plastic casing. The fiber strands in the cable transfer data signals in the form of light and travel hundreds of miles per hour.

Wireless Infrastructure

5G Mobile / Cellular Technology

Fifth-generation cellular (5G) is quickly being deployed throughout the country, with theoretical speeds of up to 20 Gbps download and 10 Gbps upload. On October 27, 2020, the FCC established the 5G Fund for Rural America, which made up to $9 billion available to bring 5G mobile broadband service to rural areas.

There are three types of 5G being deployed: low-band 5G, mid-band 5G, and millimeter wave (mmWave) high-band 5G. Each of these technologies faces its own limitations as outlined below.

Low-band and Mid-band 5G

Low-band 5G performance is only incrementally better than 4G service (about 20% faster) but has a greater reach from tower versus the mid-band 5G and mmWave high-band 5G. Mid-band 5G offers approximately six times the speed of 4G. Although having a greater range than mmWave high-band 5G, it has a shorter reach to customers from the tower. 5G technology has been designed to piggyback on the 4G network. Cellular carriers have leveraged the greater range, albeit the lesser performance of low-band 5G and mid-band 5G, to provide greater 5G service coverage. Low-band and mid-band 5G services are characterized by Verizon Wireless' Nationwide 5G service.

High-band or mmWave 5G

The mmWave high-band 5G is the fastest type of 5G with actual speeds reaching approximately ten times faster than 4G. It is characterized by exceptionally low latency and remarkably high speeds. The tradeoff is that this version of 5G has a much shorter range.[1] Where 4G is effective from 1.8 – 4.3 miles from the cell tower, the range of mmWave high-band 5G is roughly 1,500 feet (0.3 miles) from each tower. Therefore, many antennas are required to cover a given area. The mmWave high-band 5G is not widely available and is characterized by Verizon Wireless' Ultra-Wideband Service, which is available in portions of the northern half of Tompkins County.

To become more ubiquitous across the country, 5G needs more high-band, mid-band, and low-band frequency spectrum. The FCC is prioritizing additional high-band spectrum for cellular providers with the release and auctioning of five gigahertz of 5G spectrum. Over 600 megahertz of spectrum will be released for mid-band 5G. The FCC is also acting to improve use of the low-band spectrum to enable wider coverage of 5G service.[2]

Many of the wireless towers in the region have cellular equipment installed on them to provide cell phone-based coverage. The service coverage of a typical cellular tower can vary anywhere between one and ten miles depending on the equipment in use, how the equipment is set up, terrain, and the height of the towers.

Cellular service providers typically limit bandwidth and charge customers on a "data cap" rate, limiting the Mbps used per month. Once customers reach their data cap, they may have to pay for additional data or have their speeds throttled. This can make data plans expensive for heavy internet users.

Fixed Wireless

Fixed wireless broadband uses radio waves instead of cables, phone lines, or fibers. That makes fixed wireless a suitable option for providing internet access in remote locations. Download speeds of up to 1 Gbps and upload speeds of up to 1Mbps are possible with the average download speeds being closer to 25 Mbps.[3] Most wireless internet service providers enforce a data cap, which limits how much data can be transmitted to the customer over a given period of time. Fixed wireless is dependent upon a clear line of sight, as hills, trees, and weather can influence the performance of the network.

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1 Did You Know There Are Three 5G Network Types? (ces.tech)

2 America's 5G Future | Federal Communications Commission (fcc.gov)

3 How Fast Is Fixed Wireless Broadband? (beyondreach.com)

Satellite

Satellite providers use geostationary satellites to transmit signals from the network operations center to a satellite dish mounted on a business or residential structure. Download speeds up to 100 Mbps and upload speeds up to 3 Mbps are possible.[4]

The latency of satellite internet is typically 0.5 seconds, which is much higher than fiber optic's latency 0.015 seconds. (Latency is the amount of time it takes for data to travel from one point to another.) This can cause problems with VPN connections and time-sensitive activities, such as video conferencing and live online gaming. Speed performance can also be negatively impacted by weather and line of sight issues. Additionally, most satellite internet plans have a monthly data cap. Once surpassing the data cap, speeds are dramatically reduced.

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4 Best Satellite Internet Providers of 2023 | SatelliteInternet.com

3. Inventory Data

This section of the report presents data on broadband providers in Tompkins County. The data was collected from a variety of sources, including three Towns, Clarity Fiber Solutions, Haefele TV Inc., Hughes Network Systems, and Verizon; field inventory data; and secondary research. New York State Department of Public Service (NYS DPS) provided the data from its broadband inventory to Tompkins County for the purpose of reviewing underserved and unserved addresses. Utilizing the NYS DPS information made available to ECC, the field inventory included broadband infrastructure found to the extent possible by performing quality checks and physically driving roads within the county. The data collected included all relevant service providers, including the incumbent service providers, the competitive service providers, cable TV providers, and others.

This section also provides additional information on specific provider infrastructure, including fiber optic cable, wireline boundaries, Central Office locations, and wireless towers.

The incumbent telephone companies, or ILECs (incumbent local exchange carriers), and the incumbent cable TV providers are the primary owners of telecommunications infrastructure within the region. There are also several CLECs (Competitive Local Exchange Carriers) focused on businesses only, alternative fiber owners, a satellite provider, and three main cellular companies operating in Tompkins County.

Each of these providers uses different methods of delivering services to their customers, resulting in varying speeds and reliability. Typically, fiber provides the fastest, most reliable speeds, while coax, copper wire, wireless, and satellite provide lower speeds and less reliability. These factors are important to bear in mind when determining whether businesses and residents truly have adequate access to effective internet services.

This section is an introduction to the major providers and different types of infrastructure used in Tompkins County to deliver broadband service. A summary map that shows the available and important infrastructure is also included.

The broadband providers in Tompkins County are delivering service to homes, businesses, and other organizations with varying degrees of access, performance, and cost. The infrastructure in use by the industry includes landlines consisting of copper, coaxial, fiber optic, or wireless technology utilizing strategically placed towers and satellites.

Several providers have communicated that the high cost of “Make Ready” work, including moving existing utility pole attachments and electrical equipment, replacing poles with new taller poles, relocating existing electric infrastructure, surveying New York State rights of way, paying fees to New York State to occupy or cross their rights of way, and other permitting expenses, could negatively impact the construction of new broadband infrastructure in NYS, including Tompkins County. In July 2020, New York State passed legislation to incorporate one-time and annual fees for any fiber optic cables placed within or crossing NYS rights of way. These fees were rescinded in the 2022-23 NYS

Budget. However, the NYS Department of Transportation continues to approve the design of fiber optic cables in NYS rights of way.

To begin understanding broadband in Tompkins County, it is important to understand what and where the providers' claim to provide service. Then we can look at the provider infrastructure data, inventory data and the secondary research data to fine-tune our understanding.

Infrastructure Overview

Utility Poles

Utility poles and telephone poles are generally owned by the local power companies, the incumbent telephone companies, or the municipalities, such as villages and cities. Utility poles are used to carry electric power lines and telecommunications cables. The electrical power lines are generally located at the top of the pole while the telecommunication lines are attached below power lines. To be compliant with the National Electric Code, there must be 40 inches of separation between a telecommunications line and a power line on the pole. The area where the telecommunication cable resides is known as the "comm space."

All poles have a limited number of telecommunications lines they can carry. Taller poles can accept more lines than shorter ones. Once lines are installed on a pole, adding a new line can require moving existing lines to make space for the new one. This is called "Make Ready" work.

The majority of the poles in Tompkins County are owned by the utility company New York State Electric and Gas (NYSEG). Other pole owners include ILECs, such as Frontier and Verizon, and the Ontario and Trumansburg Telephone Company (OTTC), Empire Access, and the Village of Groton.

Tower Structures to Support Wireless Technology

Wireless technologies are the fastest-growing segment of the telecommunications industry. Wireless infrastructure supports cell phones, pagers, personal digital assistants (PDAs), mobile data terminals, messaging, and internet services. Wireless antennas or access points are located on wireless towers, tall buildings, and even water towers throughout the county. In some instances, the wireless infrastructure installed can offer connectivity in areas where landline infrastructure cannot.

Wireless bandwidth technologies are developing at a rapid pace. Hybrid solutions that are using fiber as the backhaul and wireless as the "last mile" are being tested and installed across the country. Using fiber cable to get close to the customer, new and emerging wireless technologies are bridging the gap by providing high bandwidth service over the last mile, which is the costliest link to the customer's home. These new hybrid systems can provide speeds of 50Mbps and more. Cellular companies and wireless internet service providers (WISPs) are upgrading their networks in preparation for new wireless technologies that will allow them to connect to customers in rural environments. The key to

wireless providers accessing rural areas is the availability of fiber infrastructure and vertical assets where they can place their antennas.

Incumbent Local Exchange Carriers (ILEC's)

The telephone company, or ILEC (incumbent local exchange carrier), and the incumbent cable TV providers are the primary owners of telecommunications infrastructure within the county. There are also several Competitive Local Exchange Carriers (CLECs) – all but one focused on businesses services only. There are no WISPs identified as serving the county. However, three satellite providers, and several cellular companies offer services within Tompkins County.

The wireline infrastructure for Tompkins County is primarily owned and operated by Incumbent Local Exchange Carriers (ILEC's) which include Frontier, Verizon Communications, and Ontario and Trumansburg Telephone Company.

Verizon Communications territory covers almost the entire county and is therefore the dominant incumbent telephone company in the county. Verizon's main hub for network support and business operations for the region is in Albany, NY. Verizon offers dial-up, T1 and DSL from many of its COs (Central Offices) located in the county. Utilizing NYS DPS data, the following map shows the advertised download speeds offered to customers by telephone carriers in respective census blocks.

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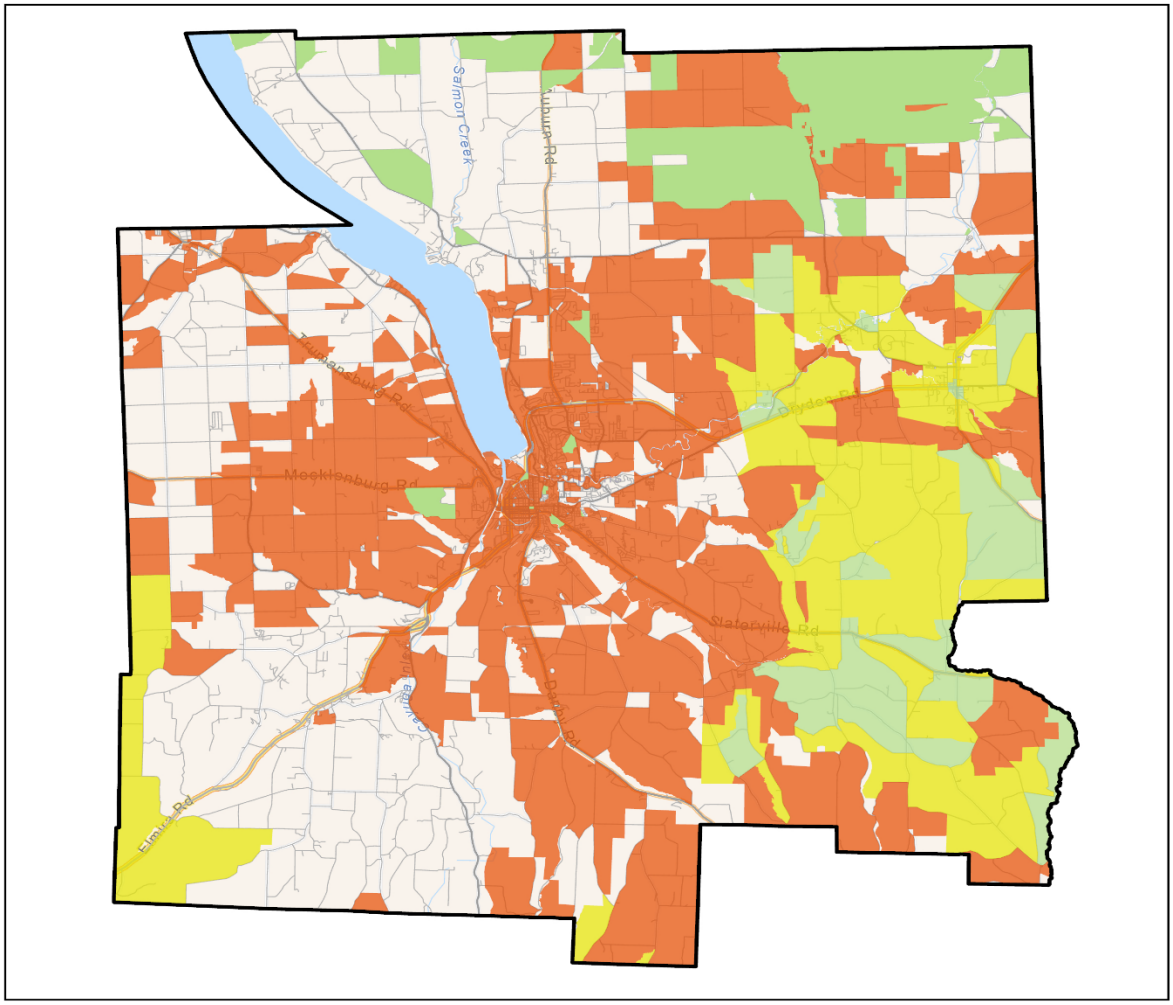

FIGURE 2: TELEPHONE PROVIDER (ILEC) INTERNET SPEED OFFERINGS (AS OF SPRING 2023)

Central Offices (COs)

The Central Office is a building, typically made of brick or concrete block, that the incumbent telephone company uses to place and operate voice, data, and video switching equipment. The equipment used in the local Central Office determines the level and availability of services within a certain area or "wire boundary" which is the extent to which the wires leaving the CO can reach.

TABLE 3: TOMPKINS COUNTY CENTRAL OFFICES

ILEC	Address	City
Frontier	6 South St	Dryden, NY
Frontier	305 Main St	Etna, NY
Verizon NY, Inc	101 W South St	Groton, NY
Verizon NY, Inc	E Side Cemetery Rd	Mclean, NY
Verizon NY, Inc/Terra Nova Telecom	212 N Tioga St	Ithaca, NY
Verizon NY, Inc	Pleasant Grove Rd NY	Ithaca, NY
Verizon NY, Inc	S Side Main St	Newfield, NY
Citizens Telecomm	2729 Slaterville Rd	Slaterville Springs, NY
Verizon NY, Inc	E Side Myers-Ludlowville	Lansing, NY

As discussed earlier in the report, the ILEC is responsible for development and maintenance of the cabling and switching equipment needed to deliver local telephone and broadband related services to the communities in their territory.

Below describes the telecommunications services currently available at each of the ILEC's Central Offices. These services are supported by switch technology at the location of the Central Office and may or may not be available to a customer within the exchange. The service is dependent upon the cabling infrastructure available and the distance from the serving Central Office. The service information is based on the provider's FCC 477 reporting as of June 2020.

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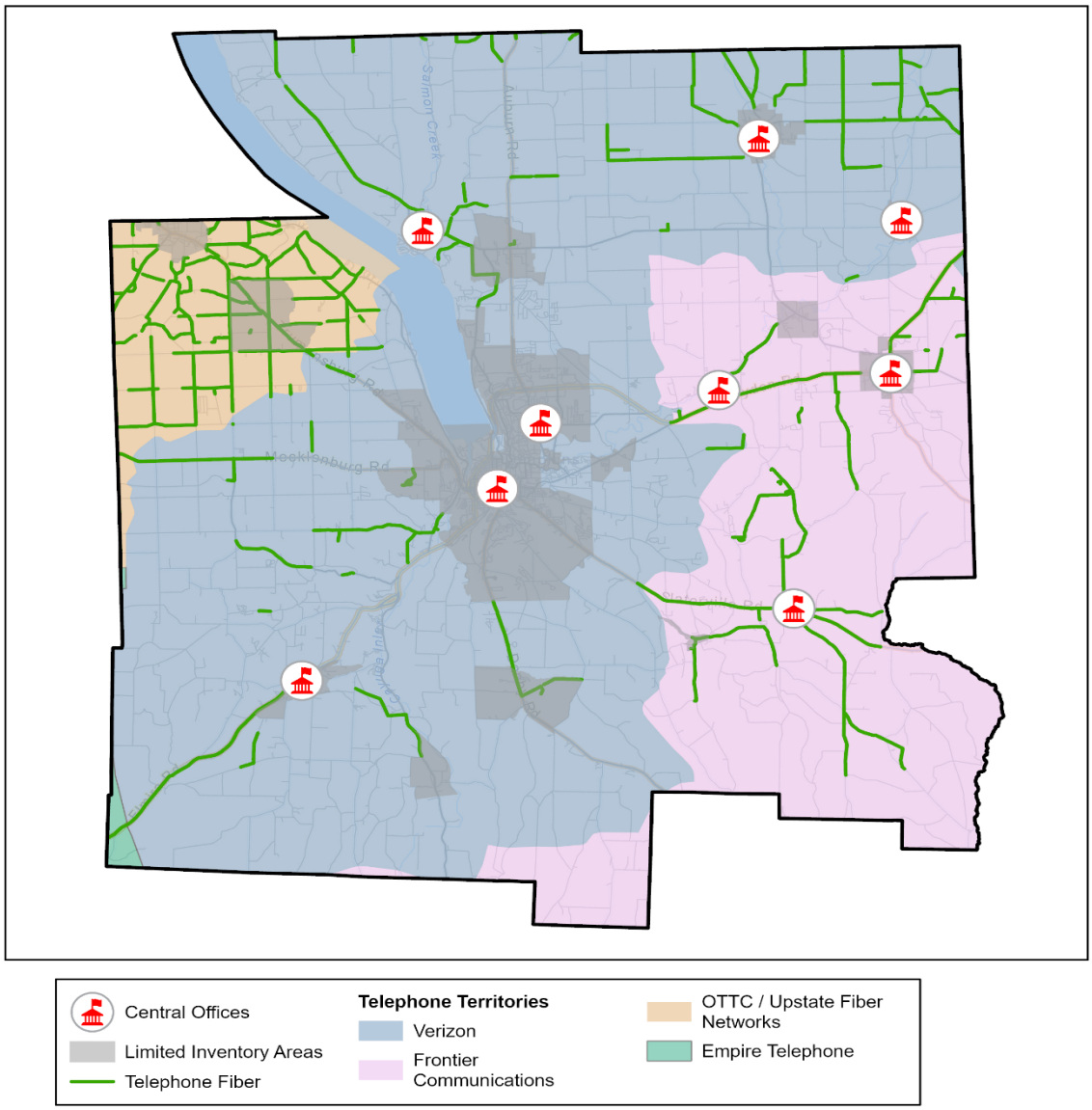

FIGURE 3: TOMPKINS COUNTY ILEC TERRITORY AND CENTRAL OFFICES (AS OF SPRING 2023)

Telephone Company Fiber to the Home Areas

Prior to 2022, all facilities-based broadband providers were required to file data with the FCC twice a year (Form 477) where they offer Internet access service at speeds exceeding 200 kbps in at least one direction. Mobile providers file maps of their coverage areas for each broadband technology. This format utilizing Form 477 was in place until December of 2022. This information was reported prior to any provider being awarded funds through applicable grants such as Rural Digital Opportunity Fund (RDOF) and Connect American Fund (CAF). Since the providers have committed to 1 Gigabit service, that bandwidth speed is already available in some select areas or will be available in the future.

Figure 5 on the next page illustrates the areas where fiber to the home infrastructure has been constructed within the county based on FCC 477 reporting. This information was used to determine service and provider by area. Under these guidelines, only one address in a census block needed to be serviced by a provider to qualify the entire area as served.

This was replaced by the new Broadband Data Collection System. This system is now used to collect broadband availability at each address, rather than by census block. The first filing for this new system was due June of 2023 but was extended to September of 2023 due submission errors and lack of data.

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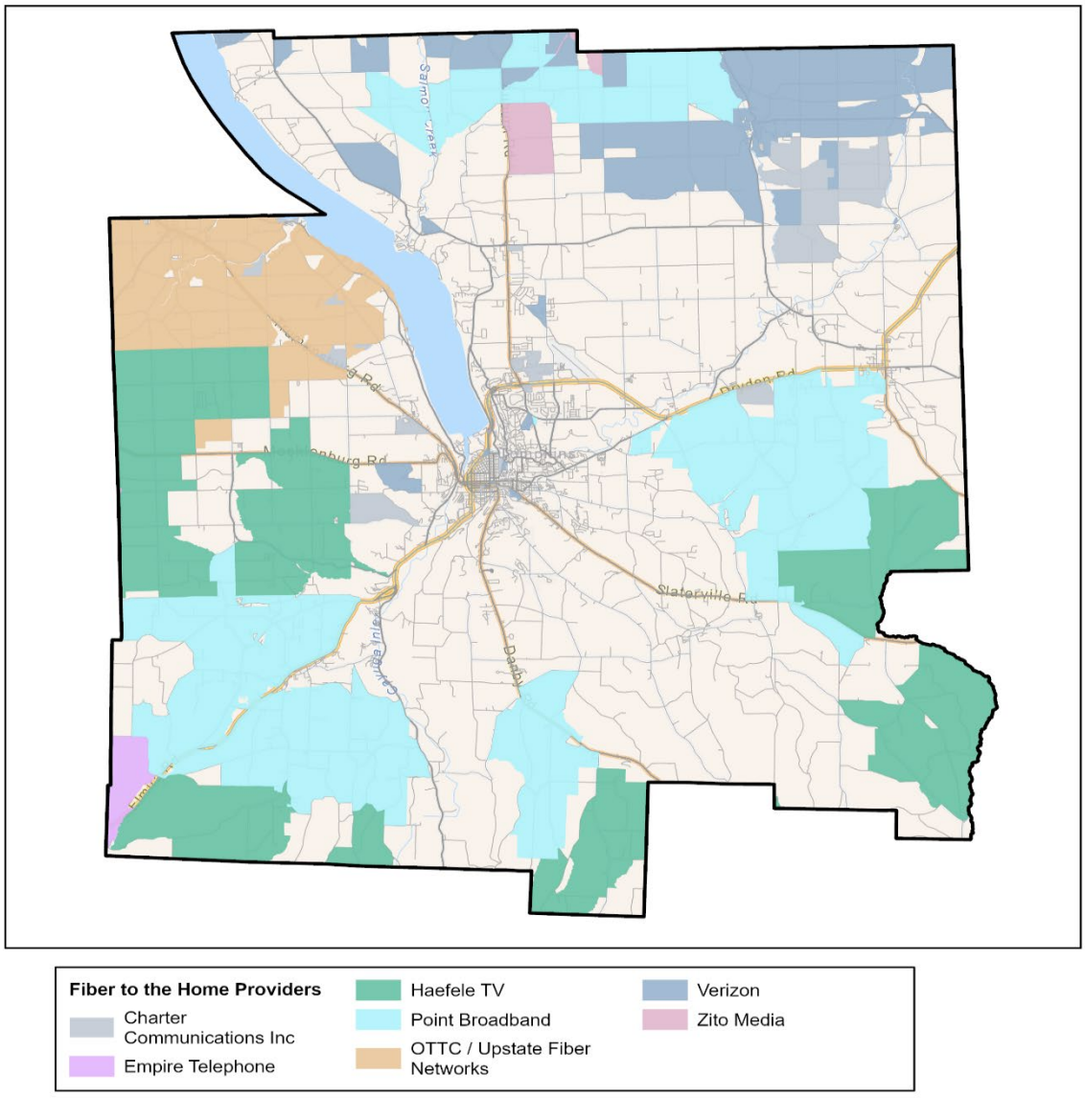

FIGURE 4: TOMPKINS COUNTY PROVIDER FIBER AREAS (AS OF SPRING 2023)

Dark Fiber

Dark fiber is the term used in the industry to describe fiber optic strands (in the cable) that are leased or sold to the customer or end user without services delivered over them. Unlike fiber from a service provider, the end user must light and operate the fiber strands with their own electronics. This type of fiber is typically used to connect multiple locations together over an end user's private network. The advantage of dark fiber is that the end user has control over the type of technology and network used, however the end user is also responsible for operation and maintenance of the infrastructure. Examples of entities that may utilize dark fiber are county and town governments, higher education, and hospital systems. Dark fiber networks are ideal for creating a closed-looped system for these institutions that have multiple buildings, allowing them to interconnect over a fiber optic network that is not shared with other customers.

Southern Tier Network

The Southern Tier Network (STN), formed in 2011, is an example of a dark fiber network operating in the area. STN is a nonprofit, open access telecommunication organization that operates and leases bandwidth on a middle mile, dark fiber infrastructure. The network is an all-fiber, 600+ miles, serving eight counties in New York's Southern Tier, including a portion of Tompkins. STN leases fiber capacity to telecommunication carriers, ISPs, government, educational institutions, healthcare organizations and commercial and industrial enterprises.

Competitive Local Exchange Carriers (CLECs)

CLECs are telephone companies created to compete with the Incumbent Local Exchange Carriers (ILECs). CLECs arose due to the Telecommunication Act of 1996, which was intended to promote competition among long-distance and local phone service providers.

The term is used to differentiate between new or potential competitors and established local exchange carriers. ECC identified the CLEC companies in Tompkins County. These CLECs include Point Broadband, FirstLight Fiber and Empire Access.

FirstLight Fiber

FirstLight is a fiber-based service provider that provides internet, data center, cloud and voice services to enterprise and carrier customers in New York, New Hampshire, Vermont, Massachusetts, and Maine over the Company's own fiber optic network. Over the past years they have made acquisitions, such as Oxford Networks, Sovernet Communications, Finger Lakes Technologies Group, 186 Communications and most recently a local fiber optic construction company, Todd Cable. In New York, FirstLight has long-haul fiber routing through Tompkins County. They provide services to small and

large businesses as well government, public safety, healthcare, education, and carriers/service providers. Their offerings include dedicated internet access, ethernet, cloud services, and dark fiber.

Point Broadband

Point Broadband (PB) formed in 2017 with a mission to improve lives by delivering 100% fiber networks and best-in-class customer service to underserved areas of rural America. Through partnerships with communities and local utility companies, PB has helped stoke economic development and allowed small-town businesses and families to enjoy a level of connectivity normally only found in big cities. PB provides Fiber to the Premises (FTTP) within the county.

Empire Access

Empire Access is a telecommunications company serving residential and business customers in Upstate New York and Northern Pennsylvania. They are part of Antin Infrastructure Partners which has completed the acquisitions of Empire Access and North Penn Telephone. Empire Access is a FTTP provider in the county.

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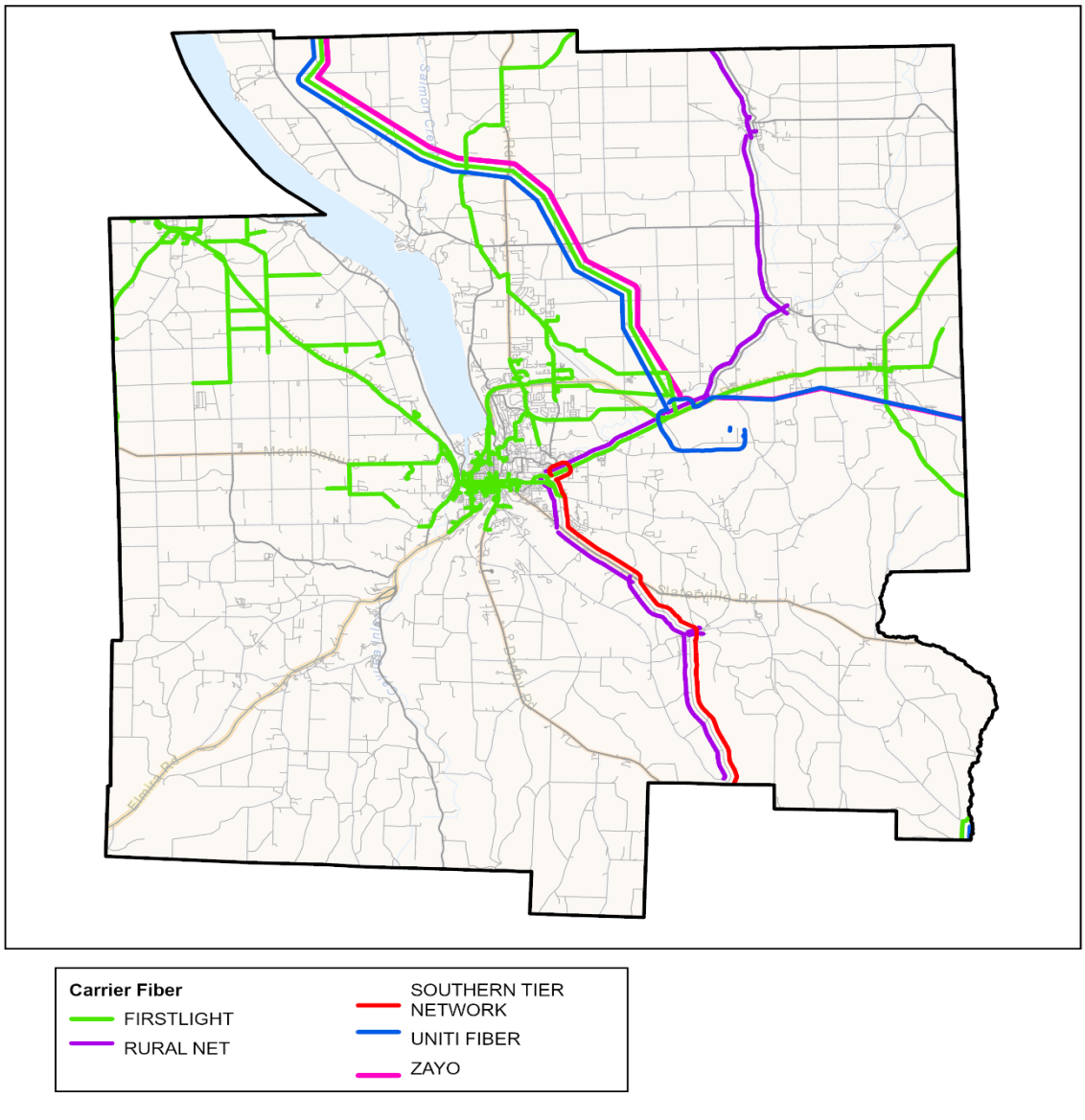

FIGURE 5: TOMPKINS COUNTY CARRIER FIBER MAP (AS OF SPRING 2023)

Cable TV Broadband Provider

Cable providers, like all service providers, will typically build and provide new services where they deem profitable, typically at or about twelve homes per mile. Should a company or residential customer purchase a service in an outlying area and be willing to pay for the line extension to their address, the cable provider may expand access, providing service along that new route to businesses and residents. These extension costs can be quite high, which can pose a barrier to those wishing to extend services. Cable providers offer their service via fiber optic or coaxial cable. Haefele Connect and Spectrum are the primary cable TV providers offering services in Tompkins County.

Haefele Connect

Haefele Connect, which has been in service for over 35 years, is a cable TV provider from Spencer, NY that provides commercial and residential triple play services of voice, internet, and cable TV. Typically, a cable modem or cable box will be required to be installed that connects to the resident's home router. Their service area covers the southern portions of Tompkins County.

Spectrum (Charter)

Spectrum is a national cable TV provider that provides commercial and residential triple play services of voice, internet, and cable TV. They are the largest provider of this type in the region.

As part of the Charter Communications/Time Warner Cable merger that formed Spectrum, New York State required Spectrum to expand its network to pass 145,000 unserved and underserved homes in rural areas of the State (including 2,970 in Tompkins County). As of September 3, 2021, Spectrum reported to the Public Service Commission that they have completed network extensions to 145,855 homes as of August 31, 2021.

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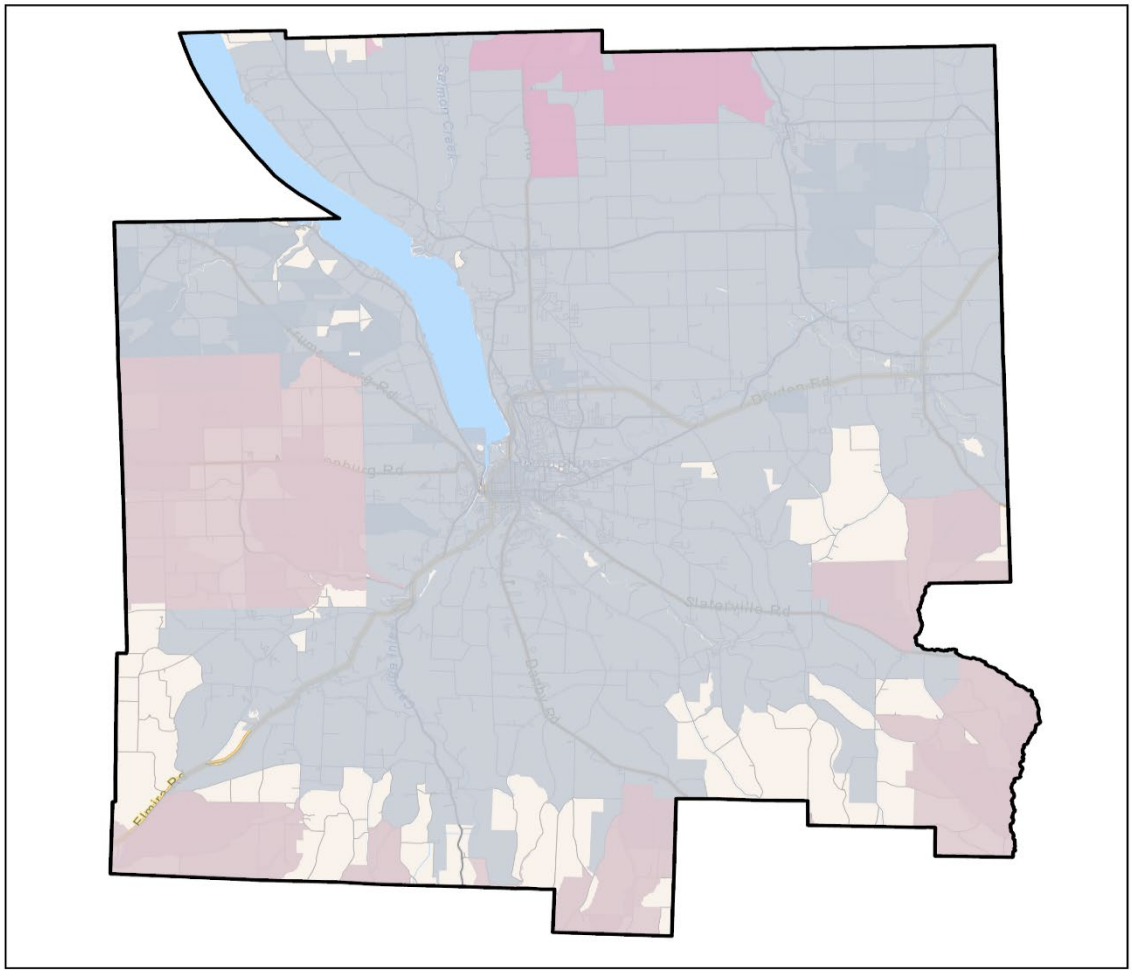

FIGURE 6: CATV SERVICE AREA AND INFRASTRUCTURE IN TOMPKINS COUNTY (AS OF SPRING 2023)

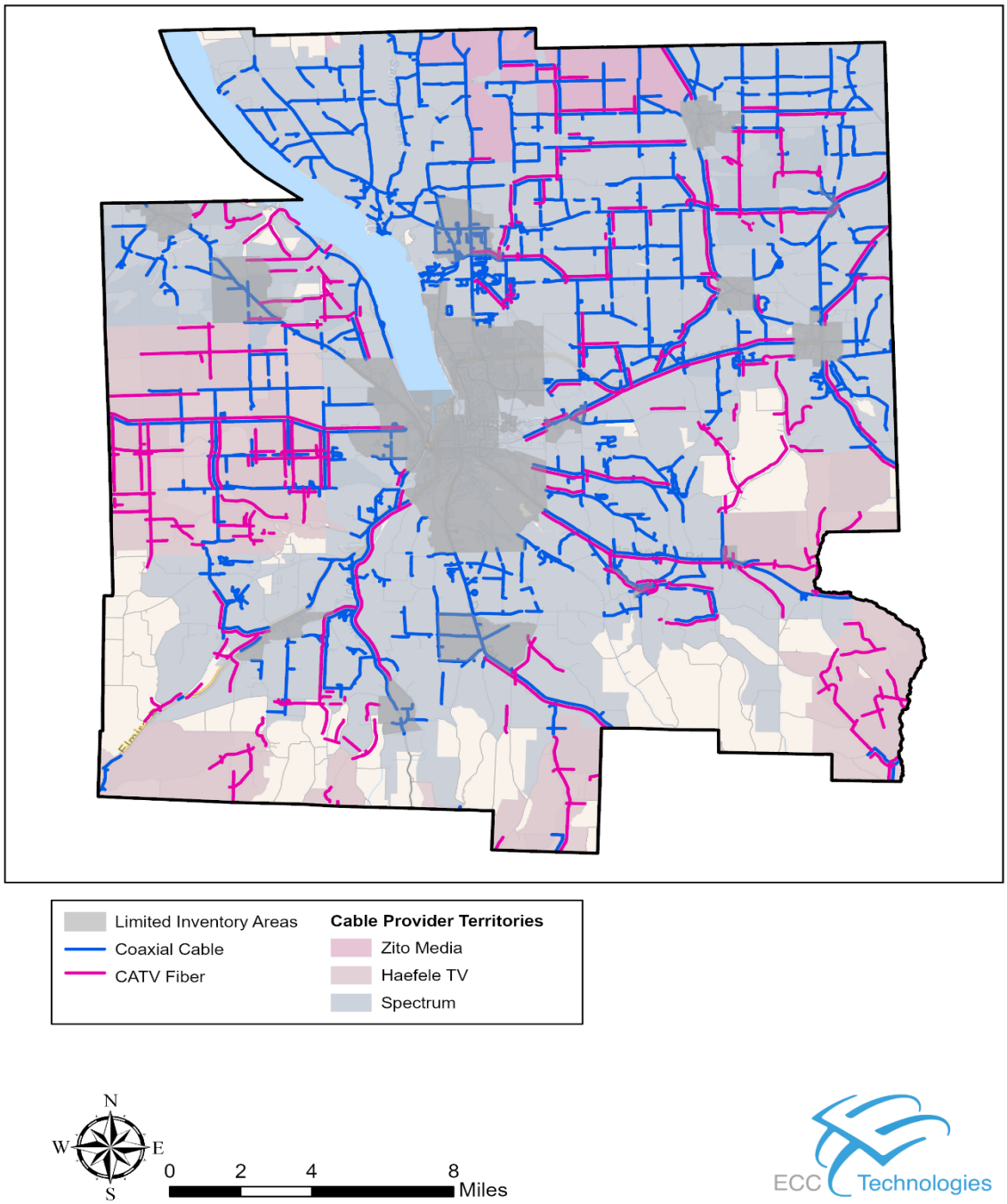

FIGURE 7: TOMPKINS COUNTY CABLE COAX AND FIBER MAP (AS OF SPRING 2023)

Wireless Tower Structures

Wireless technologies are the fastest growing segment of the telecommunications industry. Wireless infrastructure supports cell phones, pagers, personal digital assistants (PDAs), mobile data terminals, messaging, and internet services. Wireless antennas or access points are located on wireless towers, tall buildings, and even water towers throughout the region. In some instances, the wireless infrastructure installed can offer connectivity in areas where landline infrastructure cannot. A chart showing the number of towers in the county by owner can be found at the end of this section.

There are thirty-nine wireless tower structures identified either through field inspection, GIS database research, or registered with the FCC database. Many towers are located alongside major roadways and population centers, with the highest concentration of towers installed in and around major transportation arteries. The height of the FCC registered towers is up to 324 feet above ground. Owners of the registered wireless towers in the county are shown in Table 4 below. Figure 8 on the next page shows the locations of towers in Tompkins County.

TABLE 4: TOMPKINS COUNTY COMMUNICATIONS TOWERS REGISTERED WITH THE FCC

FCC Registered Towers in Tompkins County	
Owner of Tower	Quantity
American Towers LLC	2
APC Towers, LLC	2
City Switch, LLC	1
Clarity Connect, INC	2
Cornell University	1
Crown Atlantic Company LLC	2
Diamond Towers IV LLC	1
East Ohio Gas Company	1
Horvath Towers V, LLC	1
New York SMSA Limited Partnership	1
PI Towers Development LLC C/O Lendlease	1
Romar Communications INC	4
Saga Communications of New England, LLC	9
SBA Infrastructures, LLC	1
T & K Communications Systems, INC	2
Tarpon Towers II, LLC	3
Tompkins County, NY	11

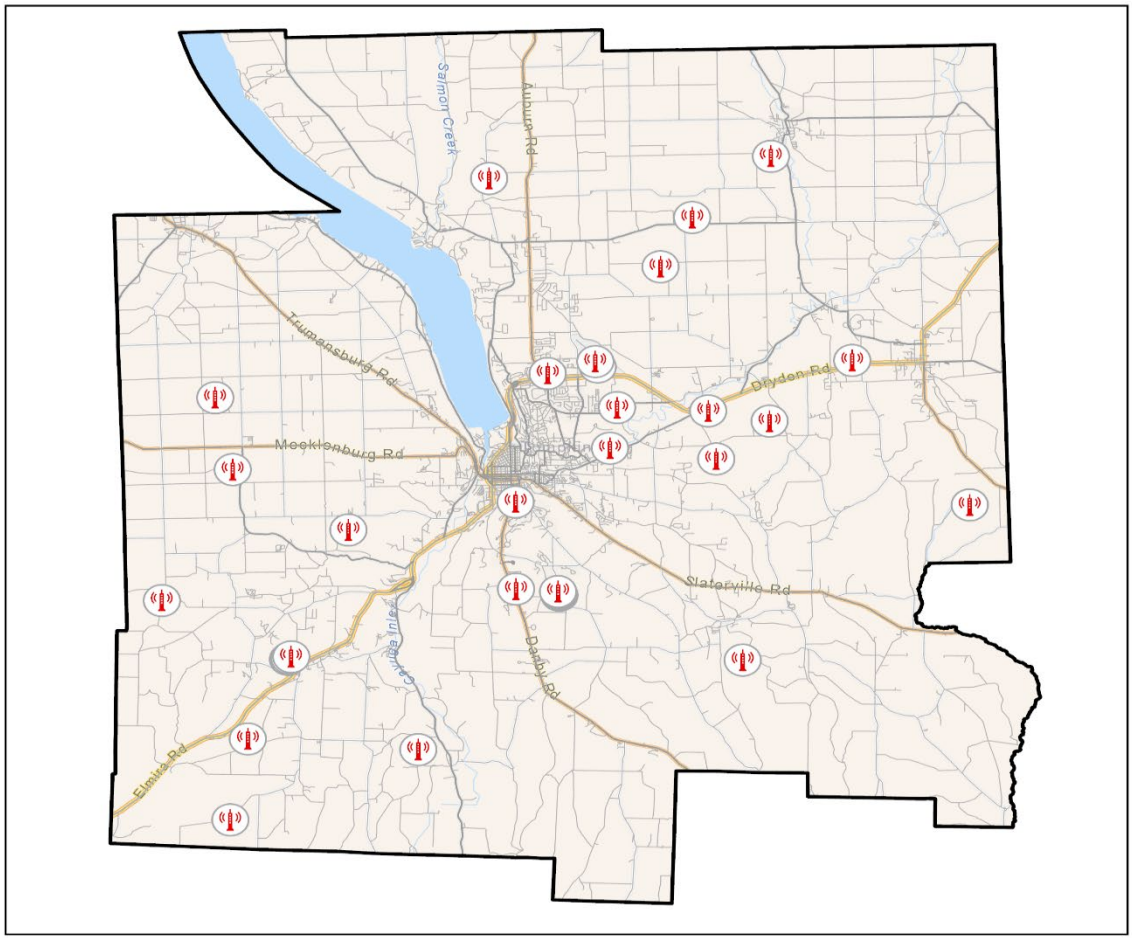

FIGURE 8: COMMUNICATIONS TOWERS IN TOMPKINS COUNTY (AS OF SPRING 2023)

Below are examples of two vertical structures in the region. Figure 9 is similar to a tower in the Town of Enfield and figure 10 is similar to a tower in the Town of Dryden. These pictures are linked to the GIS mapping information and are important to wireless internet service providers and others as they highlight availability of vertical assets that could support the installation of antennas and access point equipment.

FIGURE 9: GUYED LATTICE POLE TOWER

FIGURE 10: LATTICE TOWER

Cellular Providers

There are three national cellular service providers with complete or partial coverage in Tompkins County with varying connection speeds. The providers' website coverage maps for AT&T Wireless, T-Mobile, and Verizon Wireless are shown below. They provide 5G and 4G LTE coverage.

Cellular providers use radio frequencies to complete phone calls, send text messages, and transmit data from the nearest cell tower to the phone in use. Antennas on the towers both transmit and receive signals from mobile phones.

Cellular signals can be impacted by distance between the phone and tower, building wall thickness, hills, and other structures. Clear line-of-sight is not necessary for cellular service to work but will increase call clarity and data transmission speed.

Each respective provider's website shows their 5G, mm Wave 5G and 4 G service availability areas. AT&T states they have complete 4G coverage with 5G in most of the county.

T-Mobile claims they provide 5G Ultra coverage throughout the central area with 5G Extended, 4G and 3G/2G elsewhere. There are some small areas of no coverage along the southern border of the county.

Verizon has 5G Nationwide coverage in most of the county and 4G elsewhere in the county. They have not yet deployed their 5G Ultra-wideband service in the county.

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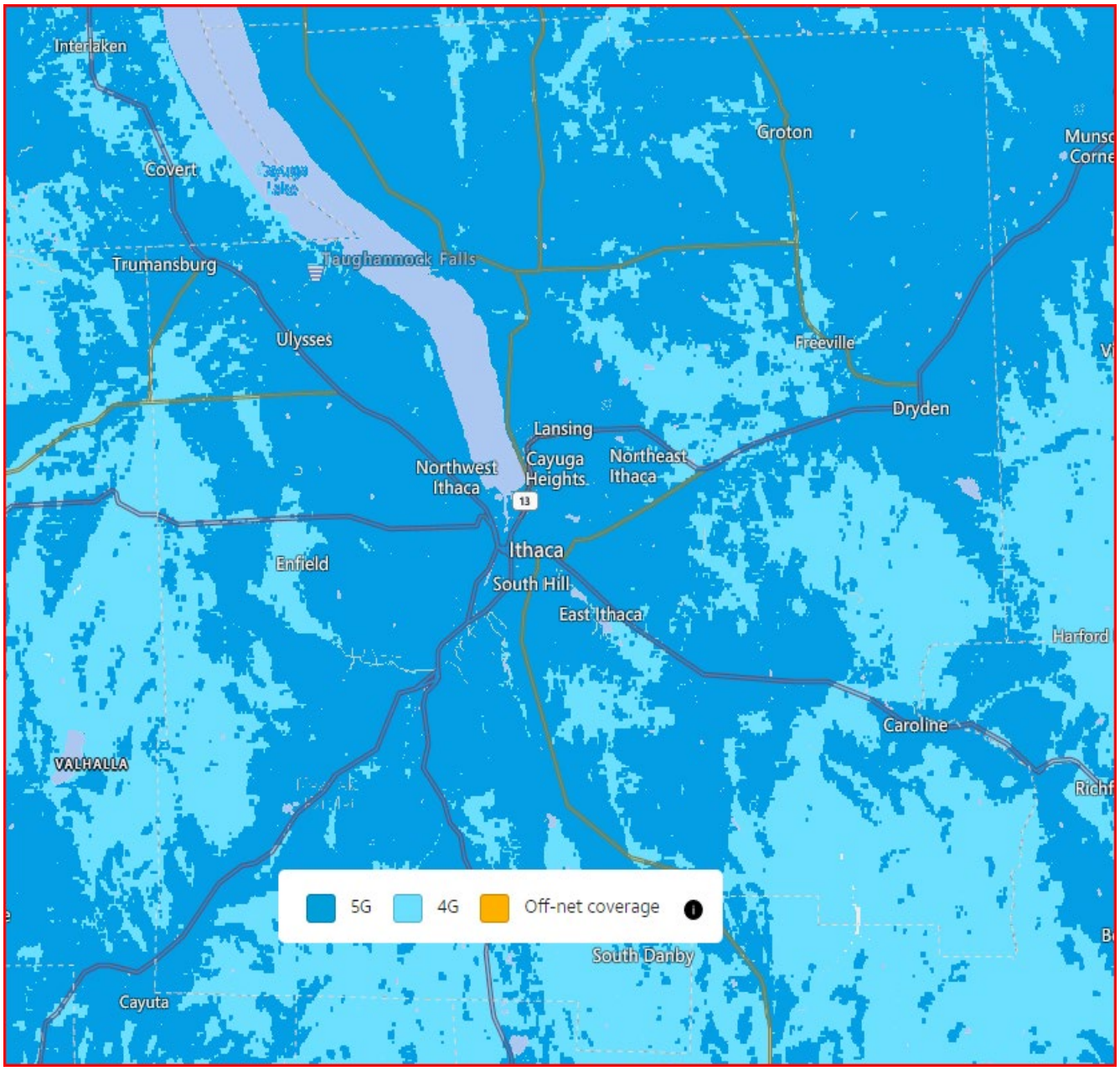

FIGURE 11: AT&T CELLULAR COVERAGE MAP IN TOMPKINS COUNTY (AS OF SPRING 2023)

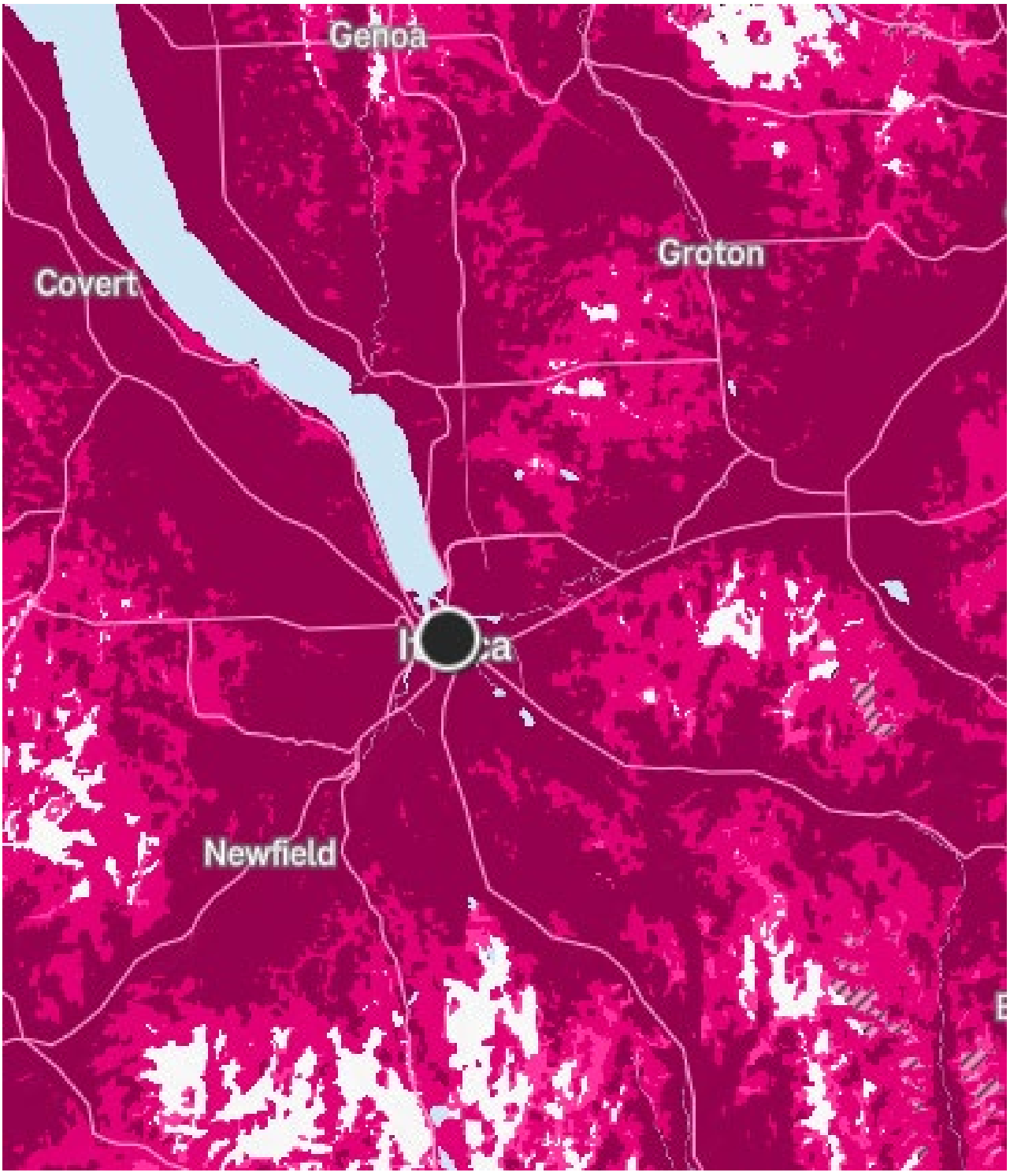

FIGURE 12: T-MOBILE CELLULAR COVERAGE AREA (AS OF SPRING 2023)

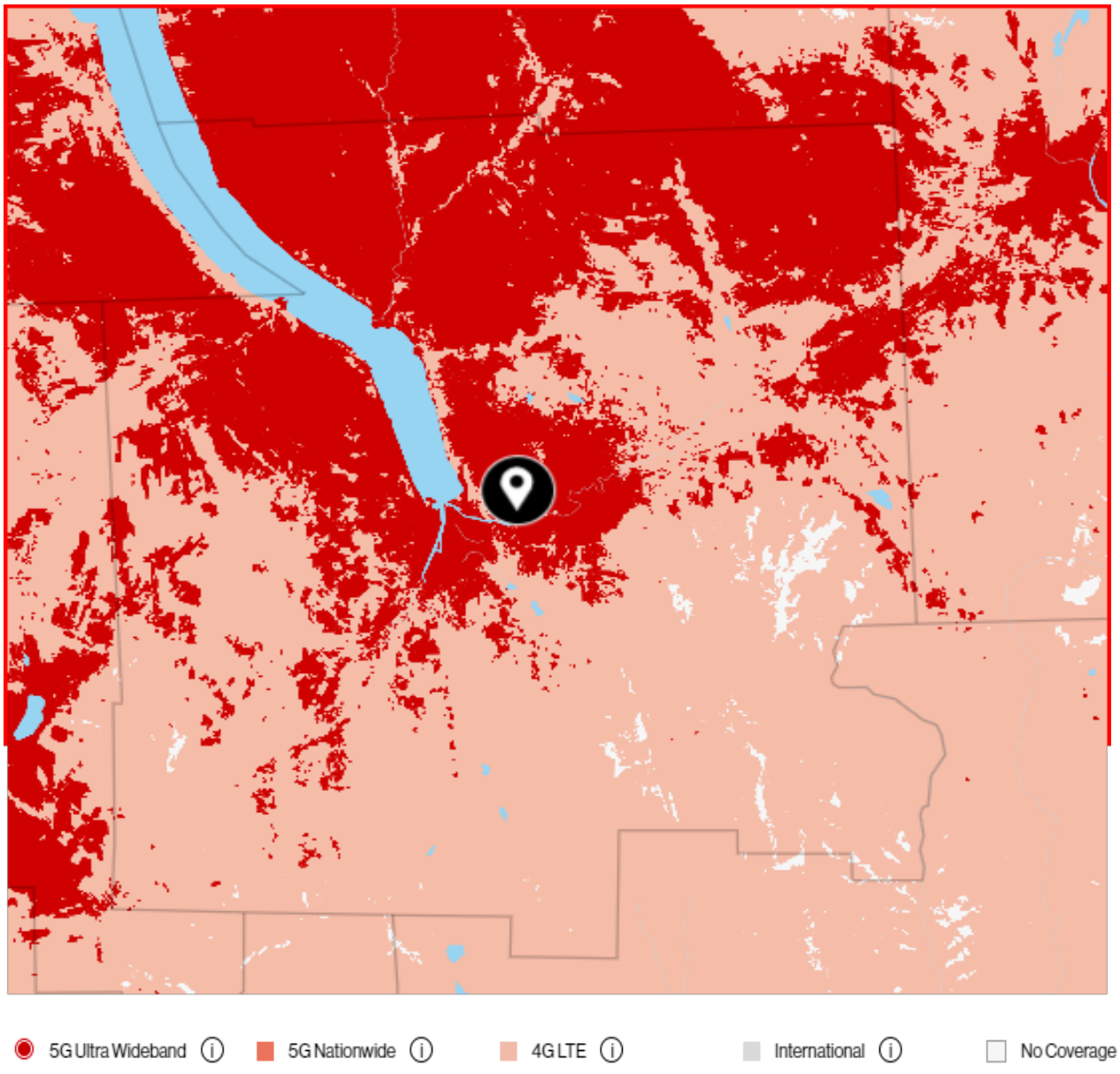

FIGURE 13: VERIZON WIRELESS CELLULAR COVERAGE IN TOMPKINS COUNTY (AS OF SPRING 2023)

Satellite Providers

The two main satellite companies servicing Tompkins County are Hughes Network Systems and Viasat. The New NY Broadband Program funded HughesNet to provide its next-generation internet service to areas it has targeted. HughesNet currently offers 25 Mbps x 3 Mbps speeds however, speeds are throttled once the data plan threshold for the particular plan is reached. Data threshholds range from 10 GB to 50 GB depedning on the plan. HughesNet has committed to the state to use its best efforts to deliver download speeds of 3 Mbps when a user's data plan has been exceeded, but with no guarrantees.

ViaSat offers download speeds ranging from 12 Mbps to 100 Mbps (Below or meets FCC Minimum) with their data plan.

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4. Options and Recommendation

Summary of Options

Tompkins County has options to consider when evaluating how best to move forward with serving all unserved addresses within the county. The County must weigh each option to determine which option or combination of options will provide the best outcome for the county and its residents. In most, if not all options, Tompkins County should consider partnering opportunities with the providers to apply for grants to access current and developing federal and state broadband funding programs. County decision-makers should consider one of the five options below to provide broadband coverage to the unserved and underserved.

Option 1: RFP to Existing and New Broadband Providers:

Tompkins County would issue a Request for Proposals (RFP) to identify providers that desire to provide access to unserved homes in the county and are willing to invest in the expansion of their network with financial support from Tompkins County and/or grant programs to supplement the capital construction. It is expected the provider(s) awarded would contribute financially to the construction. Typically, this investment by the provider(s) would be an amount equivalent to or greater than the amount the provider would normally fund without a contribution from the homeowner or a public subsidy. The County and/or grant funding would supplement the provider(s) investment to expand the network to the unserved homes.

Estimated Cost: $7 Million

Estimated Time to Fully Implement: 3-5 Years

The opportunities and benefits to this solution include:

Unserved Addresses: The unserved addresses would have broadband service available to them.

Competition: The possibility that the award could go to a new provider in the county, which would bring a new competitive choice in provider, service, and price to the rest of the county.

Ownership: The providers would have ownership of the network along with all the responsibilities of operating the network, servicing customers, and responding to any infrastructure breakages that need repair, etc.

Access to infrastructure: Tompkins County could negotiate for an Indefeasible Right of Use (IRU) for access to infrastructure, or to have broadband provided to County facilities by the awardee in exchange for the funding provided by the County.

Revenue Generation: Not applicable.

Drawbacks and vulnerabilities to the solution include:

Contribution: The County could end up contributing taxpayer dollars simply as a public service and without a way to recover the investment. Tompkins County would need to identify a source for capital funding or grant match.

Grants: Some of the grants, such as US Department of Agriculture Rural Utilities Service (USDA RUS) Grants, can be onerous to apply for and administer.

Competition: The selected bidder could already be the dominant provider in the area. In that case, expanding their service to unserved addresses, although a benefit, would not help in providing a competitive choice to the rest of the county except in areas where the service would require overlap with other provider networks.

Ownership: The County would not own any portion of the network. Should the provider offer poor service, the County would have limited recourse and would not be able to bring in an alternate provider to replace the awardee.

An example of another county that has chosen this solution is Onondaga County, NY. Onondaga officials released an RFP to have service providers bid on the amount of supplementary funding needed to build their respective networks to include the unserved addresses. The county was divided into four quadrants that enabled the providers to bid on one or more quadrants. Verizon was awarded the contract and has agreed to provide service to unserved addresses. As a benefit, Verizon will provide a viable competitor to the incumbent provider in the county Charter Spectrum. Wayne County and Genesee County also issued RFPs for broadband providers to bid on, in order to provide coverage to unserved addresses. Wayne County awarded their RFP to Charter Spectrum and entered into a broadband infrastructure grant agreement in July 2023. This agreement will bring 100% broadband coverage to county residents.

These three counties chose this option as it was viewed by county leaders as the most viable option, given county funding available, projected broadband provider contributions and ability to provide broadband service to unserved areas in a relatively short period of time. It should be noted that these three counties also committed a substantial amount of American Rescue Plan Act (ARPA) funding to these projects.

Option 2: Direct Negotiations with Broadband Providers

The County would identify one or more providers that desire to provide access to unserved homes in the county and are willing to invest in the expansion of their network with financial support from the county and/or grant programs to supplement the capital construction. It is expected the provider selected would contribute financially to the construction. Typically, this would be an amount equivalent to or greater than the amount the provider would normally invest per home passed. The county/grants would supplement the provider(s) investment to expand the network to the unserved homes.

Estimated Cost: $7 Million

Estimated Time to Fully Implement: 3-5 Years

The opportunities and benefits to this solution include:

Unserved Addresses: The unserved addresses would have broadband service available to them.

Competition: The possibility that the award could go to a new provider in the county, which would bring a new competitive choice in provider, service, and price to the rest of the county.

Ownership: The provider selected would have ownership of the network along with all the responsibilities of operating the network, servicing customers, and responding to any break fix issues.

Access to infrastructure: The county could negotiate for an IRU for access to infrastructure, or to have broadband provided to county facilities by the awardee in exchange for the funding provided by the county.

Revenue Generation: Not applicable.

Drawbacks and vulnerabilities to the solution include:

Contribution: The county may end up contributing taxpayer dollars without a way to recover the investment.

Grants: Some of the grants, such as US Department of Agriculture Rural Utilities Service (USDA RUS) Grants, can be onerous to apply and administer.

Competition: The selected provider may already be the dominant provider in the area. These providers expanding their service to unserved addresses, although a benefit, would not help in providing a competitive choice to the rest of the county.

Ownership: The county would not own any portion of the network. Should the provider offer poor service, the county would have limited recourse and would not be able to bring in an alternate provider to replace the awardee.

An example of this solution is Lewis County. The county negotiated with Charter Spectrum, the predominant broadband provider in the county, to extend their network to a portion of unserved homes in the county. This project will allocate Lewis County ARPA funds to provide broadband service to 366 addresses in five towns.

Option 3: Public/Private Partnership:

The public/private partnership model positions Tompkins County to work in partnership with a provider to deliver broadband to unserved addresses in the county. The County would own the infrastructure and establish an IRU agreement with a provider to utilize the network. In exchange, the provider would maintain and operate the network on the County's behalf. The provider would supply all services, including customer service, billing, and customer support. The provider would pay the County a percentage of revenues collected to offset the Tompkins County capital investment.

Estimated Cost: $21 Million

Estimated Time to Fully Implement: 5 Years

The opportunities and benefits to this solution include:

Unserved Addresses: The unserved addresses would have broadband service available to them.

Competition: Depending upon the provider selected, the provider ideally would be a competitor to the dominant provider in the area offering competitive service and price to the rest of the county.

Ownership: The County would own the infrastructure. The provider selected would have all the responsibilities of operating the network, servicing customers, and responding to any infrastructure breakages that need repair. If the provider defaulted on providing acceptable services, such as lengthy internet outages, failure to make agreed-to upgrades of their network, the county would have the option to bring another provider to use the network.

Access to infrastructure: The County could negotiate to have broadband provided to county facilities by the awardee in exchange for the funding provided by the county.

Revenue Generation: The county could require the provider to pay the County regularly based upon the percentage of revenue generated. This would help the County recoup its initial investment.

Drawbacks and vulnerabilities to the solution include:

Contribution: The County would need to identify a source for capital funding or grant match.

Grants: Some of the grants, such as US Department of Agriculture Rural Utilities Service (USDA RUS) Grants, can be onerous to apply and administer.

Competition: The selected bidder could already be the dominant provider in the area. These providers expanding their service to unserved addresses, although a benefit, would not help in providing a competitive choice to the rest of the county except in areas where the service would require overlap with other provider networks.

Ownership: The County would own the infrastructure, leaving the county vulnerable to an unused asset should broadband providers choose not to utilize the network.

An example of this solution is the Southern Tier Network (STN). This network, created in 2011, received $9.8 million in initial funding from Corning Incorporated, in partnership with the Southern Tier Central Regional Planning and Development Board and Chemung, Schuyler and Steuben Counties to create a 250-mile fiber network.

STN was established to promote economic development, provide critical health, public-safety, and emergency management infrastructure, and facilitate access to affordable broadband services in unserved and underserved areas in the Southern Tier Central region of New York State.

As part of the Southern Tier East expansion project, this network expanded to Allegany, Yates, Tioga, Tompkins, and Broome Counties and is now over 600 miles across eight counties. Several broadband providers, including Empire Access and Verizon, utilize this network to provide broadband service to residents and businesses.

Option 4: Open Access Model (Middle Mile)

Some areas are choosing to develop a Middle Mile, Open Access, Dark Fiber network. This creates fiber infrastructure throughout the area which providers can lease to cost effectively expand their service territories. The fiber would also be available to be leased to any entity desiring to do so, such as hospitals, colleges and universities, financial institutions, and K-12 schools. In addition, the Open Access Network would be used to connect county facilities, Public Safety Answering Points (PSAP's), public safety towers, libraries and municipal buildings establishing a private network enabling the county to possibly save significantly on their telecom/broadband budget.

With this model, the county would establish a Local Development Corporation (LDC) to own and operate the Network. It would be led by a board of directors with representatives chosen from the county and from private institutions such as from the healthcare, financial and education sectors. The LDC would hire third-party contractors to perform all the necessary functions to operate, maintain and sell the network.

Estimated Cost: $14 Million

Estimated Time to Fully Implement: 5 Years

The opportunities and benefits to this solution include:

Unserved Addresses: In many cases, middle mile networks do not have an extensive last mile component to them, meaning that some unserved residential addresses may not have broadband service available to them. However, this network extends infrastructure to remote/rural areas of the county that would otherwise be cost prohibitive for a provider to build to offer services in these areas.

Competition: The open access network is open to all providers to leverage to expand their respective service areas cost effectively. This invariably enables competition and choice in provider, service, and price for the rest of the county.

Ownership: While the LDC owns the capital infrastructure, the taxpayers could recoup some if not all their investment should the network be sold outright.

Access to infrastructure: The county could negotiate with the LDC for an IRU in exchange for its funding to connect county facilities with dark fiber, providing the county with potentially significant annual savings over current broadband/IT expenses.

Revenue Generation: The county could generate revenue through leasing the network to broadband carriers and private entities, such as hospital systems.

Drawbacks and vulnerabilities to the solution include:

Contribution: Not only does the county need to obtain funding for the construction of the network, but the county will also need to provide sufficient funds to support operations of the network until it generates enough revenue to be self-sustaining.

Grants: In June 2023, the NTIA provided funding for middle mile grants to several projects across the country. However, funding for a middle mile grant in Central New York was not awarded. At this time, it is unknown if federal/state funding will become available for a middle mile network.

Competition: A middle mile network would bring competition to Tompkins County by offering broadband providers access to the network. However, in many cases, dominant broadband providers do not access middle mile networks, for service to residential addresses.

Ownership: The LDC will own the network along with all the responsibilities of operating the network, servicing customers, and responding to any break fix issues.

An example of this solution is Erie County NY. The county set aside $34 million in ARPA funding to build and operate a 400-mile open access dark fiber network. They have created an LDC, ErieNet, to own and operate the network (ErieNet Middle Mile Dark Fiber Network). The county will be leveraging the fiber to connect all county buildings, PSAP's, towers and libraries, among other facilities. The fiber is routed through many of the unserved and underserved rural areas of the county which will enable providers to leverage the open access fiber to extend their networks to these areas. From an economic development position, the open access dark fiber being in development zones is an important benefit to entice and secure developers.

Erie County chose a middle mile network as the best solution to improve broadband coverage and speeds throughout the county. The county also sought to use a middle mile network to offer more choices for government, business, and residential customers. The County Executive also cited the need for more fiber optic cable as a top priority to improve service and attract and retain businesses in the county with this network.

Option 5: County-Owned Fiber to the Home Broadband Network

Under this option, the county would design, build, operate and maintain a 1,253-mile Fiber to the Home (FTTH) network. The County would own the infrastructure and form its own ISP to run a municipal broadband operation and serve customers. It would be in direct competition with existing ISPs to attract and retain customers.

Estimated Cost: $95-100 million for construction costs. In addition to construction costs, the annual operating and maintenance costs are projected to be $13 million. The total annual costs of this system, covering all expenses and interest under a 20-year loan, would approach $20 million. A Pro Forma for a residential-only network and a residential and business combined network is shown at the end of this option.

Estimated Time to Fully Implement: 5+ Years

Given that the county would own, operate, and maintain this network, the county would need to develop a plan for addressing customer service tasks, such as repairs to the system on

roadways and inside homes, and establishing a customer call center and billing system, among several other items. It is highly recommended that the county hires contractors for operations and maintenance, rather than add county employees, as that would create long-term financial obligations. While this type of work can be contracted out, the county would still need to create a Director and Administrative team to oversee Operations and Maintenance contractors.

The opportunities and benefits to this solution include:

Unserved Addresses: The unserved addresses will have broadband service available to them.

Competition: The county-owned network would be open to other providers to leverage and provide services. Each would likely expand their respective service areas beyond the pockets of services provided today. This would enable competition and choice in provider, service, and price.

Ownership: County-owned asset where access and prices are set by the county. This asset could also be sold at a future date.

Access to infrastructure: County residents, businesses and providers would have access to a fiber optic cable system countywide.

Revenue generation: The County would generate revenue through commercial and residential sales, providing an ongoing revenue stream for operations and maintenance.

Drawbacks and vulnerabilities to the solution include:

Contribution: Not only does the county need to obtain funding for the construction of the network, but the county will also need to provide sufficient funds to support operations of the network until it generates enough revenue to be self-sustaining. Therefore, start-up costs on both the construction and operations and maintenance will be substantial.

Grants: The county would need to obtain funding for the construction of the network, as well as sufficient funds to maintain operations of the network until it generates enough revenue to be self-sustaining. It may be difficult to obtain long-term funding for operations and maintenance, as public grant programs rarely provide funding for ongoing operations.

Competition: Local providers have made significant investments in infrastructure and services and this option would directly compete for customers. They may choose to lobby local and State officials against this proposal, which could cause delays and cost increases. Additionally, dominant providers would most likely not utilize this network, as they would view it as competition.

Ownership: The county would own the network along with the responsibilities of operating the network, servicing providers and/or customers, and responding to any infrastructure breakages that need repair break fix issues. The operations of the network would be on a 7X24 basis with executed contracts in place. The county would also need to ensure system reliability and upgrades as technology will continue to advance.

An example of this solution is Madison County. Given the large number of unserved addresses in Madison County, they applied for and were successful in obtaining a USDA ReConnect Grant with their selected partner Empire Access. Madison County will own the 269-mile network and Empire is the last mile provider that will operate and maintain the network. Empire will provide last-mile services including broadband internet, CATV, voice services, and security services to their customers over the network. Empire will be responsible for all customer service and billing. Empire will compete directly with existing service providers offering a competitive choice to those in the county that would otherwise not have a choice in provider. Madison County will receive a percentage of the revenue generated by Empire Access from the network. These funds will be funneled back to the county's general fund to replenish the capital invested in the network.

Madison County chose to pursue a ReConnect grant as they had an interest in owning the network and the partnership this program created with a broadband provider. Additionally, this grant program offered an opportunity to provide broadband service to a portion of the county where providers were reluctant to extend their existing network due to the low density of addresses. The ReConnect grant also offered an opportunity to bring service to both unserved and underserved addresses.

While this is a not a county-wide network, this is the closest example to a county-owned network in New York State that will provide services to residential and commercial addresses for both unserved and underserved communities.

TABLE 5: COUNTY-OWNED FIBER TO THE HOME NETWORK PRO FORMA

Loan Term (Yrs)	Rate	Construction Cost	Loan Amortization Annual Cost	Annual O&M Costs	Capital Replacement Fund Annual Costs	Total Annual Costs	Monthly costs	# of Customers total 47,993	Monthly Cost Per Residential Customer
10	0.0%	$ 95,000,000	$9,500,000	$12,350,000	$ 1,500,000	$ 23,350,000	$ 1,945,833	26,396	$ 74
15	0.0%	$ 95,000,000	$6,333,333	$12,350,000	$ 1,500,000	$ 20,183,333	$ 1,681,944	26,396	$ 64
20	0.0%	$ 95,000,000	$4,750,000	$12,350,000	$ 1,500,000	$ 18,600,000	$ 1,550,000	26,396	$ 59

Loan Term (Yrs)	Rate	Construction Cost	Loan Amortization Annual Cost	Annual O&M Costs	Capital Replacement Fund Annual Costs	Total Annual Costs	Monthly costs	Monthly Impact of businees	Residential share	Monthly Cost Per Residential Customer
10	0.0%	$ 100,000,000	$10,000,000	$13,000,000	$ 1,500,000	$ 24,500,000	$ 2,041,667	186,038	1,855,629	$ 70
15	0.0%	$ 100,000,000	$6,666,667	$13,000,000	$ 1,500,000	$ 21,166,667	$ 1,763,889	186,038	1,577,851	$ 60
20	0.0%	$ 100,000,000	$5,000,000	$13,000,000	$ 1,500,000	$ 19,500,000	$ 1,625,000	186,038	1,438,963	$ 55

Recommendation

ECC believes that due to the relatively few number of unserved addresses and the effective relationships Tompkins County has built with the existing providers, it would be in the best interest of Tompkins County and its residents to leverage these relationships and explore incentives to the providers to expand their networks to those unserved and underserved areas of the county. This may be the most efficient way to provide coverage to all. Therefore, ECC believes that it would be in the best interest of the County and its residents to release a Request for Proposal (RFP) to interested providers or Option 1 as the first step in providing high-speed broadband access to all of the unserved addresses.

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Appendices

The appendices provide background on broadband access, descriptions of the digital divide and efforts in Tompkins County to close the digital divide, funding opportunities, ISP data, technical terms, and a glossary.

Appendix A – Broadband Access

Broadband access has become one of the foundational resources that allows a community to compete and thrive in the 21st century. Infused into all aspects of our social and economic life, broadband connects computers, cell phones, television, and most modern communications. Tompkins County has initiated a broadband project to identify businesses and households that are without access to fiber or coaxial broadband services. The goal is to formulate a solution to expand access across the county.

Tompkins County is aware that broadband powers emails, internet searches, social media, online shopping, and information management. It enables business, education, medicine, government, and public safety to perform their functions efficiently. It is a critical component of economic development and a community's ability to attract and retain industry. Recent surveys show high-speed broadband is now as important to job creation and business locations as good transportation and skilled labor.

Telecommunications infrastructure and broadband service have transformed the way people, public organizations, and companies communicate, educate, work, and live. Broadband, and the fiber optic backbones that support it, have undeniably become the "interstate highway" of the 21st century.

The use of broadband services is becoming ubiquitous. By 2023, North America will have 345 million internet users (92 percent of regional population), up from 328 million (90 percent of regional population) in 2018.[5]

In 2020 and 2021, the world moved into lockdown to protect against the spread of the COVID-19 virus. This caused a major shift in the way we perform critical tasks including work from home (video conferencing and collaboration, virtual private network access to company systems), learning from home (video conferencing and collaboration and access to e-learning platforms), telemedicine (video conference with healthcare professionals and access to healthcare systems).

The pandemic also had personal impacts including shopping (ordering food and items for delivery or curbside pickup) and entertainment (video streaming, online gaming, social media). Fixed broadband traffic increased up to 60%, voice traffic increased up to 130% and Wi-Fi calling increased up to 80%.

5Cisco Annual Internet Report - Cisco Annual Internet Report (2018–2023) White Paper - Cisco

People across the country endured social distancing and self-isolation due to the pandemic. The situation has brought to light the importance of remote healthcare, learning, and working from home. The COVID-19 pandemic exposed the nation's persistent broadband issues including availability, affordability, and speed of service exponentially.

As many people were quarantined in their homes, lack of access in rural areas received unprecedented attention from both federal and state agencies announcing new grant programs for broadband expansion. In 2015, the Federal Communications Commission (FCC) set the standard for broadband access at 25Mbps download by 3Mbps upload.

In July 2023, FCC Chair Rosenworcel proposed changing the standard to 100 Mbps download and 20 Mbps upload. As part of this announcement, the FCC also issued a Notice of Inquiry (NOI) to increase the national fixed broadband standard under Section 706 of the Telecommunications Act. Additionally, many federal broadband grant programs, including the Broadband, Equity, Access, and Deployment (BEAD) program, require 100/20 Mbps. The NOI proposes a separate national goal of 1 Gbps/500 Mbps for the future.

Broadband's Role in Today's Society

Today broadband is considered infrastructure as critical as roads, electricity, and water. Inadequate broadband has become a barrier to community growth, competitiveness, and economic development. This has led to something called "The Digital Divide."

Digital equity, a component of the Digital Divide, is a condition in which all individuals and communities have the information technology capacity needed for full participation in our society, democracy, and economy. Everyone can contribute to digital equity by ensuring everyone has access to the internet and the necessary tools to use it. This can be done by ensuring that everyone has affordable access to the internet, as well as providing devices and software that are accessible to everyone.

Digital equity is typically used when referring to education, but it is relevant in any industry or community where technology, and specifically internet access, is essential for success. Conversations during the pandemic turned to the importance of digital equity in the workplace as the pandemic sent many employees into the ranks of remote workers.

Institutions that include schools, hospitals, colleges, and governmental agencies have the duty to ensure that services are universally accessible. This also means that these institutions need to be fully integrated with internet-based technologies in their services. This ensures that all people have access to internet, then institutions will be able to integrate.

Broadband Data Collection

Previously, fixed broadband deployment data was collected by the FCC from broadband providers offering services at a physical location. A provider that reported deployment of a particular technology and bandwidth in a particular census block may not necessarily have offered that service everywhere in the census block. Accordingly, a list of providers deployed in a census block did not necessarily reflect the number of choices available to any particular household or business location in that block, and the number of such providers in the census block did not purport to measure competition.

The problem was that the FCC's maps had previously relied on information that failed to paint the whole picture of who did and who did not have internet access. The FCC's older maps collected data at the census block level, meaning that if a single home were served in a census block, the whole block would show up as served on broadband coverage maps. The net result was maps that were overly optimistic, lacked location-specific information, and subsequently glossed over gaps in coverage.

In order to address this issue, the FCC created a Broadband Data Task Force to improve the agency's broadband data and mapping tools. With these new maps, the FCC has integrated the information from broadband providers with hundreds of location-specific data sources, giving us a far more detailed and accurate picture of fixed broadband availability.

These improved maps will mean direct benefits for consumers. Users now have a one-stop-shop to search for their address and find information about which internet service providers claim to offer service at the location, the broadband technologies they offer, and the maximum download and upload speeds they advertise for each technology. The National Broadband Map can be accessed at https://broadbandmap.fcc.gov/home. This greater transparency will create market pressures on internet providers to improve their coverage. The new maps will also help policymakers more accurately target investments to expand broadband to unserved and underserved areas and close the digital divide.

Despite these efforts, the FCC data is often inconsistent with data from reporting sources. In order to address any discrepancies, the FCC initiated a request of each state to "Challenge" the data and submit in Bulk Form or at an Individual level response.

Therefore, to provide a more granular and accurate representation of where broadband is and is not in a community, there is a need to physically inventory broadband infrastructure and analyze the data collected from within the community.

The cross-reference of field study data with the results of a broadband availability & adoption tool (BAAT) campaign will further help define areas of need in a more granular manner and provide a basis from which to obtain partners and funding. This will be discussed in the summary BAAT campaign information at the project closeout and will be provided as a separate report.

Broadband – An Everyday Necessity

The importance of Broadband is difficult to overstate. Infused into all aspects of our social and economic life, broadband enables computers, cell phones, television, and most modern communications to connect users to a broad range of services. Broadband powers email, Internet searches, social media, online shopping, and information management. It enables business, education, medicine, government, and public safety to enhance their services to customers, colleagues, and residents. It is a critical component of economic development and a community's ability to attract and retain industry.

Equally important from a business perspective has been the development of related technologies including Software as a Service (SAAS), cloud storage and other network-based applications.

Recent surveys show high-speed broadband is now as important to job creation and business locations as good transportation, robust utilities, and skilled labor. It is crucial to assess the current state of telecommunications in each area in order to make plans to correct or upgrade communications.

Telecommunications infrastructure and broadband service have transformed the way people, public organizations, and companies communicate, educate, work, and live. There is almost no facet of our daily lives that is not impacted by broadband technologies.

Broadband (and a fiber optic backbone to support broadband) has undeniably become the "interstate highway" of the 21st century. The use of broadband services is becoming ubiquitous. In fact, the average American household has access to 10 or more connected devices in the home and this number is only expected to continue growing.

Industry studies report that end user demand for bandwidth is doubling every 3 years. As discussed later, the consumer need for speed and the FCC evolving definition of broadband service has changed greatly over the past 2 decades.

The Internet of Things (IoT)

The Internet of Things (IoT) is a term used to define everything that is connected to the internet. It is estimated that in 2018 there were 22 billion devices connected to the internet. By the year 2030, the number will more than double to over 50 billion devices.[6]

IoT devices are commonplace today: Nest and Eco bee thermostats; Alexa devices; Wi-Fi enabled appliances; automated reporting from vehicles; video doorbells and cameras; mood changing lightbulbs and many more devices.

6 IoT connected devices worldwide 2019-2030 | Statista

Residential

Residential bandwidth requirements continue to be among the most rapidly growing across the telecommunications industry. Residential capacity requirements will experience an increase year over year as high-definition TV and streaming video, web access, smart home technologies, gaming, and other progressive applications will continue to drive the residential broadband market.

Commercial

In commercial environments higher bandwidth needs are expected to skyrocket due to capabilities represented by SAAS and cloud applications. The Commercial IoT represents additional demands on networks in the years ahead.

As the IoTs expand the volume of data on networks by several orders of magnitude, large amounts of sensors operating within different equipment environments will collect and transmit data to be analyzed in real time by disparate systems. Examples include real time monitoring of "Smart" electric meters, warehouse floor sensors tracking movements of parts and subassemblies in manufacturing plants, location data for mobile phone mapping support and more.

Agriculture is a key driver of networked based applications and data usage. Rural broadband represents a challenge and an opportunity to help farms optimize fertilizer, water, and other required components to maximize yields and minimize losses.

Network based applications are actively providing farmers optimized plowing and seeding patterns for fields based on real time data feedback, helping to increase yields and reduce waste and crop loss.

Modern data analytics systems and artificial intelligence (AI) will turn this raw data into actionable intelligence and will enrich the organizational decision-making processes, allow faster responses to real time requirements, and facilitate predictive and preventive maintenance.

Appendix B - The Digital Divide

On Feb 8, 1996, the FCC created the Telecommunications Act to establish competition and facilitate growth in the telecommunications industry, which previously had been a government-regulated monopoly.

After the Telecommunications Act, telephone companies called Competitive Local Exchange Carriers ("CLECs") emerged and were able to provide consumers with a choice of services. During this period other non-traditional telecommunications companies such as cable TV providers, network providers, and wireless providers (both cellular and fixed wireless) began to offer competitive broadband services to participate in the explosive growth of the internet.

Over 25 years have passed since the 1996 Telecommunications Act which succeeded in creating competition and increased availability of broadband access. Despite that success, a technology gap has occurred between communities that have access to affordable broadband service and those that do not. This division, known as the Digital Divide, has split communities into broadband "haves" and "have nots."

Currently, the FCC is pushing funding for bridging the gap of Digital Equity. Under the Broadband Equity, Access, and Deployment program (BEAD), funding has been put into place to help bridge or provide broadband services to the unserved. The key element in this program, Digital Equity, is to address the condition in which all individuals and communities have the information technology capacity needed for full participation in our society, democracy, and economy.

Digital Divide as a Service

Digital divide is when there is a gap in access to technology, internet, smartphones, or computers among social and economic groups. Education and income are the main reasons for creating a technology gap. Educated people are more adaptive to technologies and households with college graduates having more technical resources than those households with less education. Income also influences the divide which relates to the purchasing of devices capable of accessing broadband services.

Despite technology being provided, many people are still resistant to using technology. Some consider technology a threat or intrusive to their homes and religion. This can cause isolation, educational gaps, limit careers or job fulfillment and segregation between people.

Digital Learning

Digital Learning is more of a mission-critical requirement because digital literacy and digital collaboration need to be supported simultaneously. Governments and classrooms need to introduce technical learning that encompasses three key pillars of digital equity, including digital literacy, digital inclusion, and digital adoption.

Digital Literacy

Digital Literacy is the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills.

A person with digital literacy skills:

- Possesses a variety of skills – technical and cognitive – required to find, understand, evaluate, create, and communicate digital information in a wide variety of formats.

- Can use diverse technologies appropriately and effectively to retrieve information, interpret results, and judge the quality of that information.
- Understands the relationship between technology, life-long learning, personal privacy, and stewardship of information.
- Uses these skills and the appropriate technology to communicate and collaborate with peers, colleagues, family, and on occasion, the public; and
- Use of these skills to actively participate in society and contribute to a vibrant, informed, and engaged community.

Digital Inclusion

Digital Inclusion refers to the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies (ICTs).

This includes five elements:

1. Affordable and strong broadband internet service.
2. Internet-enabled devices that meet the needs of the user.
3. Access to digital literacy training.
4. Quality technical support; and
5. Applications and online content are designed to enable and encourage self-sufficiency, participation, and collaboration.

Digital Inclusion must evolve as technology advances. Digital Inclusion requires intentional strategies and investments to reduce and eliminate historical, institutional, and structural barriers to access and use technology.

Digital Adoption

Broadband adoption has traditionally been defined as residential subscribership to high-speed internet access. However, for those in the field, working to increase the digital capacity of communities, broadband adoption is daily access to the internet:

1. At speeds, quality, and capacity necessary to accomplish common tasks,
2. With the digital skills necessary to participate online, and
3. On a personal device and secure, convenient network.

Bridging technological discrimination will allow economically disadvantaged or less resourceful people to get adequate education. This will need to include a Take-Home Philosophy to provide digital access at homes. Take-Home Philosophy ensures technology is being taught, allowed to have access from home, and leads to digital awareness. Home connectivity is important to support extended learning opportunities and leads to full digital equity. Gaps in connectivity and service become known allowing for support financially and socially, bridging governments, social organizations, educators, and technological investors in a collaborative learning resource to bridge the gap between digitalization. This includes providing training to teachers and students using digital resources and educational standards.

The FCC has advised both educational organizations and local governments to establish Digital Equity Offices that work together to develop requirements and solutions to physical access and use of broadband and related digital technologies and services. Each office will need a Digital Equity Officer who reports directly to the top elected executives of a multi-member cabinet. Each office will be responsible for publishing and keeping current a Digital Equity Plan for each jurisdiction. These plans will set performance targets, establish strategies, collection of data, reporting requirements and coordinated activities across multiple agencies, including those responsible for information technologies, economic development, social services, healthcare, and others. Digital Equity Officers will serve as the lead and liaison between state and county-level peers and educational organizations.

Digital Equity Officers will formalize new ideas and consolidate the many emerging digital equity efforts in the area they represent. This includes but is not limited to State, County, Local Government agencies, and educational programs.

A Digital Equity office will need to ensure that every resident, regardless of income, race, ethnicity, or any other demographic characteristic can subscribe to wireline and wireless service. Depending on state law and the given telecommunications technology, the office would serve as either the lead or co-lead when negotiating the geography that ISPs would be obligated to serve. The office would also be responsible for monitoring service levels, including the provision of customer-facing tools to report service issues.

The FCC further advises that the Digital Equity Office should be ensuring that ISPs do not conduct digital redlining or purposefully excluding certain communities from essential services through persistent and thorough data monitoring. Any breach can be critical to avert service inequities. Finally, depending on local willingness, the digital equity office could also help coordinate the construction of any publicly owned broadband networks.

A digital equity office should co-design and co-operate with programs that make broadband and related devices more affordable for lower-income households. The office would serve as the chief negotiator with ISPs over pricing and/or targeted subsidies. This will include any concessions the local government would be willing to make for specific pricing benefits that stay within the bounds of

current FCC rules. The office would also serve as a resource for schools, housing departments, libraries, and other agencies that bulk purchase network and computing devices.

In this capacity, the office would share data from their Digital Equity Plan and combined with other economic indicators would establish procurement needs for the entire jurisdiction. The office would work with workforce boards and peers to ensure training reflects employer needs where sensible. The office would also serve as the lead agent to coordinate state and federal skills grants, including applying for grants and distributing funds to agency peers. They will support programs that build the digital skills of local households and support regional employers. The office would use performance data and local relationships to establish training needs. The office would then help support digital skills training operated by agency peers such as the local library system and external partners, including nonprofit community groups, utilizing public funding and technical capacity.

Digital Equity starts with two essentials. First is access to digital infrastructure. This largely affects rural areas, and it relates to whether residents have broadband available where they live. Next is access to sufficient speeds and to digital services, which addresses whether citizens have the money or knowledge they need to effectively use and benefit from technology. The Digital Equity office will use these two fundamental requirements as the basis for their policies and procedures.

Libraries and Schools will power this solution. Under the Infrastructure Investment and Jobs Act (IIJA) these institutions have an unprecedented funding opportunity to build on the existing infrastructure and expertise of our nation's libraries to inform state digital equity plans and accelerate broadband adoption and skills building for all throughout the county.

Libraries can provide the physical reach with their presence in communities of all sizes, as well as in K-12 schools, colleges and universities, military bases, and more that provide high-speed internet access, computers, specialty software applications, central meeting spaces, and trusted hubs for information and community referrals for people across diverse backgrounds and interests. Expertise and resources with trained staff experienced in tackling digital equity gaps, boosting literacies and digital skills needed to survive and thrive in today's networked world, and developing collections and resources relevant to local need. Sustainable, flexible collaboration ranging from digital equity coalitions to state workforce development plans to telehealth collaborations will strengthen networks and support sustainability. Increasing awareness of their local technology assets will improve coordination across all levels of government and develop proposals for required funding.

Tompkins County communities should work together to implement these plans. The Digital Divide is bridged by communities that are willing to plan and co-operate to reach their growing broadband needs.

The Changing Definition of Broadband

A standard for broadband supporting download transmission rates of at least 200kbs was established in 1999. In 2004, the FCC continued to use this standard as its definition of broadband. Unlike today, upload speeds were not considered during the development of these initial benchmarks. Business services in the region include T1, ISDN, Frame Relay and SONET. Rural areas rely on DSL and satellite with some continuing to use dial-up internet services.

Since 2004, end user bandwidth demand and requirements have accelerated. These significant changes are driven by the accelerated use of the internet including media intensive applications, increases in virtualization relative to work and education, cloud-based applications and storage and the deployment of television standards such as HDTV and 4K.

During this same period, the FCC has twice updated its definition of broadband. The first of these updates was in 2010 when broadband was redefined as 4 Mbps download and 1Mbps upload. Five years later, in 2015, FCC Chairman Tom Wheeler, increased the standard to the current definition of 25 Mbps download and 3 Mbps upload. According to Wheeler at the time the increase was necessary due to "advances in technology, market offerings by broadband providers and consumer demand."

Under federal grant programs, a new minimum standard for broadband of 100 Mbps download and 20 Mbps upload has been adopted by the FCC effective October 2021. As noted in the main report, current FCC Chair Rosenworcel would like to raise the standard speed to 100/20 Mbps, codifying it in Sec. 706 of the Telecommunications Act.

FCC Broadband Progress Report

Every two years the FCC provides a progress report on the state of broadband service in the United States. In the 2020 report, the FCC found that in 2018, 5.6 percent of the American population did not have access to Fixed Terrestrial broadband service as defined by the FCC, which is 25 Mbps downstream by 3 Mbps upstream.[7] This represents approximately 18.3 million people in the country. The report also found that fixed terrestrial service deployment in rural areas and Tribal lands lags that of urban areas. Over 22% of rural areas do not have access to 25 Mbps/3 Mbps or mobile LTE at 10 Mbps/3 Mbps based on provider reported data.

7 Microsoft Word - FCC-20-50A1-1

According to a NY state report, the state ranks second in the country in citizens having the FCC defined broadband required service of 25/3 Mbps. This makes 98.7% considered served.[8]

Historic Download Speed demand in Mbps has grown from 2015 of 25 Mbps to 121 Mbps in 2023. Forecasted Mbps demand is estimated to reach 314 Mbps in just 4 years, placing the need for starting broadband service above today's existing provided services such as satellite and cellular.

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8 Availability, Access and Affordability: Understanding Broadband Challenges in New York State | Office of the New York State Comptroller

Appendix C - Efforts to Close the Digital Divide

Despite the increased need for broadband service, rural areas of the country still rely largely on copper-based infrastructure, such as the incumbent telephone companies' unshielded twisted pair copper wire or satellite connections for broadband connectivity.

Unfortunately, upgrading copper's limited bandwidth to the high-bandwidth capacity of fiber has not been an area of focus for the telecommunications industry. This is due mainly to the high cost of installing fiber and the low population densities of rural areas that create lengthy return on investment models. Furthermore, the incumbent broadband providers are reluctant to invest in expensive telecommunications infrastructure upgrades, which do not show profitability.

Much of the infrastructure in place today in these areas has been in operation for more than 50 years. Most of the telecommunication industry is focusing elsewhere, with investment dollars being spent in high-growth areas such as tier 1 and tier 2 cities, where fiber cable is densely installed. Comparable to the lack of electricity in rural areas of this country before the National Rural Electrification Act of 1936, many areas in New York State are being rapidly left behind.

Two of the initiatives that expanded broadband coverage into the rural communities of New York State include the 2016 Charter Communications/Time Warner Cable merger and the "New NY Broadband (grant) Program". These two programs are now complete, and Tompkins County should focus on other federal and state grant programs to bring coverage to unserved areas.

There are federally subsidized programs to expand local incumbent provider broadband such as the America Rescue Plan Act (ARPA) of 2021, Connect America Fund (CAF), Rural Digital Opportunities Fund (RDOF), the USDA ReConnect program, and New York State's program of ConnectALL[9]. However, as broadband is not a publicly regulated service, like telephone service, there are no obligations for the provider to make new broadband investments in unprofitable areas.

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[9] ConnectALL | ConnectALL Office (ny.gov)

New NY Broadband Grant Program

Since 2016 and coincidentally with the Charter/Time Warner merger, New York State offered three rounds of grant funding, through the New NY Broadband Grant Program, to support the deployment of broadband to unserved and underserved residences and businesses. Over $62.8M was allocated to broadband expansion in the Central New York Region.

Awardee	Funding Units	State Grants	Private & Federal Commitment	Total Investment
Central NY Region	15,115	$43,239,989	$20,648,886	$62,888,875

Tompkins County received $2,199,362 through the New NY Broadband Grant Program. The tables below provide the breakout of New NY Broadband grant funding and total investment funds in Tompkins County by provider, followed by a breakout by town per provider.

TABLE 6: NEW NY BROADBAND GRANT INVESTMENT IN TOMPKINS COUNTY

Awardee	State Grant	Total Investment	Locations Addressed	Pct of Locations	Pct of Investment
Clarity Fiber Solutions	$1,243,189	$1,553,988	242	20%	54%
Haefele TV Inc.	$745,298	$983,141	526	43%	34%
Hughes Network Systems, LLC	$95,605	$185,720	451	37%	6%
Verizon	$115,270	$175,606	16	1%	6%
Total	**$2,199,362**	**$2,898,455**	**1235**		

Haefele TV, now known as Haefele Connect, is a local cable service provider, created in 1983 in the Enfield area. They provide CATV, internet service and digital phone service. Table 7 shows the New NY Broadband Grant awards to Haefele TV Inc. by township.

TABLE 7: NEW NY BROADBAND GRANT PROVIDED TO HAEFELE TV INC.

Location (Town)	State Grant	Total Investment	Locations Addressed
Caroline	$242,793	$303,499	136
Danby	$110,113	$137,643	44
Enfield	$348,280	$435,351	325
Newfield	$44,112	$106,648	21
Total	**$745,298**	**$983,141**	**526**

Clarity Fiber Solutions, also known as Point Broadband, is a wireless internet service provider headquartered in Ithaca, NY. It was founded in 1995 for the purpose of providing high-speed internet to underserved rural areas in New York State using LTE/WIMAX or 5.8GHZ technology with fiber optics where applicable. Table 8 shows the New NY Broadband Grant awards to Clarity Fiber Solutions by township. Clarity Connect was also awarded $2,216,000 for the Tompkins and Cayuga Counties Last Mile Coverage project.

TABLE 8: NEW NY BROADBAND GRANT PROVIDED TO CLARITY FIBER SOLUTIONS

Location (Town)	State Grant	Total Investment	Locations Addressed
Caroline	$118,154	$147,693	23
Danby	$92,469	$115,586	18
Dryden	$431,520	$539,401	84
Groton	$200,349	$250,436	39
Lansing	$82,194	$102,743	16
Newfield	$318,503	$398,129	62
Total	**$1,243,189**	**$1,553,988**	**242**

Verizon provides wireline and wireless service in Tompkins County. This includes fiber (Fios) services to businesses and residential locations. Fios will deliver internet, TV, and phone over fiber optic network. However, Verizon also provides DSL services that are offered at 15 Mbps, which is below the minimum speed required by the FCC. Below, in Table 9, is the NY Broadband Grant money awarded to Verizon by township.

TABLE 9: NEW NY BROADBAND GRANT PROVIDED TO VERIZON

Location (Town)	State Grant	Total Investment	Locations Addressed
Groton (Town)	$108,066	$162,603	15
Lansing	$7,204	$13,003	1
Total	**$115,270**	**$175,606**	**16**

Hughes Network Systems (HNS) is currently owned by EchoStar, which is headquartered in Germantown, MD. HNS provides satellite internet service in Tompkins County. HughesNet currently offers satellite service at 25 Mbps, which is the minimum speed required by the FCC. Below, in Table 10, is the New NY Broadband Grant money awarded to HughesNet by township.

TABLE 10: NEW NY BROADBAND GRANT PROVIDED TO HUGHES NETWORK SYSTEMS

Location (Town)	State Grant	Total Investment	Locations Addressed
Caroline	$13,703	$22,685	82
Danby	$17,010	$38,891	75
Dryden	$9,136	$13,896	55
Dryden Village	$158	$225	1
Enfield	$4,252	$7,412	14
Groton	$4,410	$6,301	28
Ithaca (City)	$1,890	$2,700	12
Ithaca (Town)	$315	$450	2
Lansing (Town)	$22,680	$51,635	91
Lansing (Village)	$158	$225	1
Newfield	$18,270	$36,125	67
Ulysses	$3,623	$5,175	23
Total	**$95,605**	**$185,720**	**451**

Rural Digital Opportunity Fund (RDOF)

In 2020, the FCC Regional Digital Opportunity Fund (RDOF) program replaced the Connect America Fund, better known as CAF. This 10-year $20.4B grant program will bring fixed broadband and voice service to millions of unserved homes and small businesses in rural America. Building on the success of the Connect America Fund Phase II Auction, RDOF uses a two-phase, competitive reverse auction

(Auction 904) that prioritizes higher network speeds and lower latency to ensure the deployment of robust, sustainable high-speed networks that meet the needs of consumers now and in the future. The second auction date (Phase II) has not been set. Phase II will cover locations in census blocks that are partially served, as well as locations not funded in Phase I.

The award amount is paid out to the winning bidder in yearly installments over a 10-year period. Under the RDOF rules, the service provider winning the award has three years to complete 40 percent of their build and six years to complete the full buildout.

There is some concern with this program because it allows competitors to continuously underbid each other, to maintain or gain market share. Many areas could see a "race to the bottom" that will potentially produce unstainable business models.

Other fears include uncertainty as to whether some of the companies that have been awarded the money will be able to construct the system they have committed to building. In January 2022, a letter signed by 160 senators and House representatives urged the FCC to be fastidious with its review and confirm that the winners can deliver on their respective system build-out commitments.

The two award winners in Tompkins County for Phase I were Point Broadband Fiber Holding and Space Exploration Technologies Corporation, known as SpaceX. In August 2022, the FCC rejected Space Exploration Technologies' RDOF grant, worth nearly $1 billion. In their rejection of the award, the FCC stated that SpaceX "failed to demonstrate that the provider could deliver the promised service," in particular the speeds and reliability of those speeds. The SpaceX RDOF award is shown in the table and map below as a reference.

TABLE 11: RDOF AWARDS IN TOMPKINS COUNTY

Awardee	Assigned Support (10 years)	Locations	Pct of Locations	Pct of Investment
Point Broadband Fiber Holding, LLC	$773,202.00	423	58.91%	70.89%
Space Exploration Technologies Corp	$317,443.00	295	41.09%	29.11%
Total	**$1,090,645.00**	**718**		

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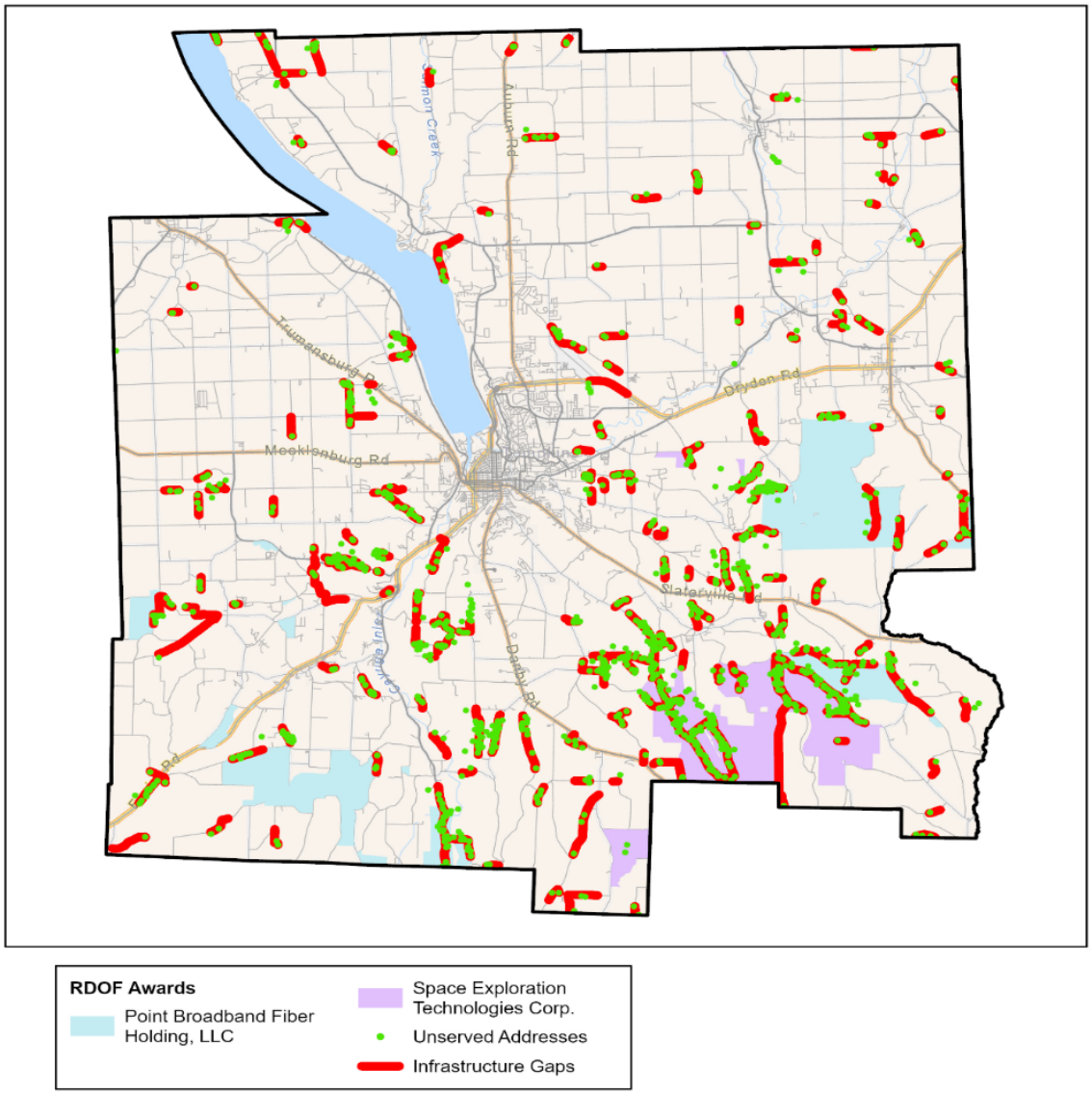

FIGURE 14: TOMPKINS COUNTY RDOF AREA MAP

Appendix D - Funding Opportunities

In order to accomplish Tompkins County's goal of providing broadband coverage to 100% of residents, this appendix provides an overview of some funding opportunities to utilize.

Several initiatives have been implemented to address broadband inequities related to availability and affordability, particularly in rural areas. Grants provide valuable resources for organizations to initiate projects or provide services in areas that would otherwise be untenable. It is important to remember grants are competitive. Much time and preparation are required to find grant opportunities, plan the project, develop a business plan, and submit the grant application or proposal. Grants support critical recovery initiatives, innovative research, and many other programs.

Broadband Equity Access and Deployment (BEAD) Program

The BEAD Program, established by the Infrastructure Investment and Jobs Act (IIJA) and administered by the National Telecommunications and Information Administration (NTIA), appropriates $42.45 billion for States, Territories, and the District of Columbia (DC) to utilize for broadband deployment, mapping, and adoption projects. Funding priorities for the program are sequential with the first funding priority to provide broadband to unserved areas (those below 25/3 Mbps), followed by underserved areas (those below 100/20 Mbps), and community anchor institutions (1/1 Gbps).

On June 26, 2023, the NTIA announced state allocations for the BEAD Program. New York State was allocated $664.6 million. By December 27, 2023, all states are required to submit an Initial Proposal to NTIA for how these funds will be spent to address the unserved and underserved. Once NTIA approves the Initial Proposal, states will be permitted to request access to at least 20% of the allocated funds. States will then select subgrantees and will have one year to complete the selection process and submit a Final Proposal to NTIA. At this point, NTIA will award the remaining 80% of funds upon approval of the Final Proposal and states will initiate their subgrants. ***It is important to note that states are not allowed to provide funding directly to counties.*** However, states are allowed to have counties provide oversight of any projects to ensure coverage to the unserved and underserved are accomplished.

American Rescue Plan (ARP) Funding

On March 11, 2021, a nationally- based $1.9 trillion COVID-19 relief package was signed into law. Included in this funding is money that can be used for broadband infrastructure development at state and local levels.

The federal government carved out $350B in what it calls the Fiscal Recovery Fund. This fund is split 60% for the states and 40% for local government. In dollars that equates to $219.8 billion that will be distributed to states, as well as the $130 billion for local governments and counties.

Counties could utilize this funding for broadband coverage. However, it should be noted that all costs of projects must be incurred by December 31, 2024. Overall project completion dates must be no later than the end of December 2026 for projects funded with the Fiscal Recovery Funds. Funds may be used for middle mile and/or last mile projects, with a focus on getting last mile services put in place.

U.S Department of Agriculture ReConnect Loan and Grant Program

Since 2018, the Federal government has appropriated funds for the ReConnect Program that provides loans, grants, and loan/grant combinations to facilitate broadband deployment in rural areas. The program hopes to fuel long-term rural economic development and opportunities in rural America.

Rural Utilities Service (RUS), a Rural Development agency of the United States Department of Agriculture (USDA), manages the program and has issued three Funding Opportunity Announcements (FOA) since its creation in 2018. Up to $200,000,000 is available for grants. The maximum amount that can be requested in an application is $25,000,000. The most recent round of funding, which allocated $40.2 million, was announced on August 4, 2022.

ReConnect grants have been awarded to Livingston, Madison, and Yates Counties. Two items to keep in mind when considering applying for ReConnect grants is that the county must own the network and the application process, as well as the implementation/reporting process for this program are onerous.

Digital Equity Act Programs

While the first step to ensure broadband coverage is available to all Tompkins County residents, the second half of meeting this goal is to provide funding for any digital needs of county residents. Appropriations of $2.75 billion, through the federal Infrastructure Investment and Jobs Act (IIJA) have also been reserved to establish three grant programs that promote digital inclusion and equity to ensure that all individuals and communities have the skills, technology, and capacity needed to reap the full benefits of our digital economy. The goal of these programs is to promote the meaningful adoption and use of broadband services across the targeted populations, including low-income households, aging populations, incarcerated individuals, veterans, individuals with disabilities, individuals with a language barrier, racial and ethnic minorities, and rural inhabitants.

The three programs are: 1) State Planning Program - a $60 million grant program for states, territories, and tribal governments to develop digital equity plans, 2) State Capacity Program – a five-year $1.44 billion annual grant program in support of digital equity projects and implementation of digital equity plans and 3) Competitive Program – a five-year $1.25 billion annual grant program to implement digital equity projects.

As the cost of internet service can also be a barrier for broadband access, Tompkins County should require any providers bidding on RFPs to be a participant in the Affordable Connectivity Program (ACP). ACP is a $14.2 billion FCC program that helps connect families and households struggling to afford internet service. This benefit provides a discount of up to $30 per month toward broadband service for eligible households and up to $75 per month for households on qualifying Tribal lands.

Eligible households can also receive a one-time discount of up to $100 to purchase a laptop, desktop computer, or tablet from participating providers. Eligible households can enroll through a participating broadband provider, or directly with the Universal Service Administrative Company (USAC) using an online or mail in application.

As of July 2023, 19.5 million households nationwide are currently enrolled in this program. At this time, there is some concern that funding will run out in mid-2024.

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Appendix E: Broadband Provider Speeds by Town and Zip Code

The following pages list internet providers, type of service offered, coverage area and the maximum speed advertised for Tompkins County by municipality. This information was gathered by keying in zip codes from an online database at BroadbandNow.com that utilizes the FCC 477 information.

There are a few towns and villages listed that are outside the County but have zip code-based areas that encroach within the County. The zip code map is shown below for illustrative purposes and can be used as a key to assist with identifying provider service.

NOTE: Some providers are servicing a zip code but are under the 25/3 Mbps requirements. While other providers can meet this requirement.

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FIGURE 35: TOMPKINS COUNTY ZIP CODE MAP

Summary Of Internet Providers in Dryden		13053		
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	90.3%	300-1000 Mbps	$49.99-$89.99
Frontier	DSL	95.1%	NA	$49.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
T-Home Internet	5G	10.5%	182 Mbps	$50.00
Verizon	DSL	4.2%	15 Mbps	$40.00-$74.99
Clarity Connect	Fixed Wireless	99.7%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	9.9%	6 Mbps	NA
Haefele Connect	Fiber	5.8%	3-250 Mbps	$35.00-$110.00
Spectrum Business	Fiber	49.4%	1000 Mbps	$164.99
Frontier Business	DSL	100%	NA	NA
Haefele Connect Business	Fiber	22.6%	300 Mbps	NA
FirstLight Business	Fiber	14.8%	NA	NA

Summary Of Internet Providers in Etna		13062		
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	100%	300-1000 Mbps	$49.99-$89.99
Frontier	DSL	100%	NA	$49.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
Clarity Connect	Fixed Wireless	100%	10 Mbps	$55.00
Spectrum Business	Cable	100%	1000 Mbps	$164.99
Frontier Business	DSL	97.8%	NA	NA

Summary Of Internet Providers in Freeville		13068		
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	95.1%	300-1000 Mbps	$49.99-$89.99
Frontier	Fiber	74.6%	NA	$49.99-$149.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
T-Home Internet	5G	14.7%	182 Mbps	$50.00
Verizon	DSL	16.3%	15 Mbps	$40.00-$74.99
Clarity Connect	Fixed Wireless	99.7%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	30.3%	6 Mbps	$50.00
Spectrum Business	Fiber	100%	1000 Mbps	$164.99
Frontier Business	Fiber	86.2%	500-2000 Mbps	$49.99-$149.99
FirstLight Business	Fiber	6.4%	NA	NA

Summary Of Internet Providers in Groton		13073		
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	94.3%	300-1000 Mbps	$49.99-$89.99
Verizon	DSL	77.5%	15 Mbps	$40.00-$74.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
Clarity Connect	Fixed Wireless	82.5%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	30.3%	6 Mbps	$50.00
Frontier	DSL	1.1%	NA	$49.99
Spectrum Business	Fiber	100%	1000 Mbps	$164.99
Kinetic by Windstream Business	Fiber	0.2%	1000 Mbps	NA

Frontier Business	DSL	1.7%	NA	NA
Crown Castle Business	Fiber	1.6%	NA	NA
FirstLight Business	Fiber	0.8%	NA	NA

Summary Of Internet Providers in McLean			**13102**	
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	100%	300-1000 Mbps	$49.99-$89.99
T-Home Internet	5G	100%	182 Mbps	$50.00
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
Clarity Connect	Fixed Wireless	100%	10 Mbps	$55.00
Spectrum Business	Fiber	100%	1000 Mbps	$164.99

Summary Of Internet Providers in Brooktondale			**14817**	
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	66.0%	300-1000 Mbps	$49.99-$89.99
Frontier	DSL	95.2%	NA	$49.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
T-Home Internet	5G	21.3%	182 Mbps	$50.00
Verizon	DSL	9.8%	15 Mbps	$40.00-$74.99
Clarity Connect	Fixed Wireless	89.4%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	41.3%	6 Mbps	$50.00
Haefele Connect	Fiber	18.6%	3-250 Mbps	$35.00-$110.00
Spectrum Business	Cable	43.4%	300-1000 Mbps	$49.99-$164.99
Frontier Business	DSL	100%	NA	NA
Haefele Connect Business	Fiber	23.1%	250 Mbps	NA

Summary Of Internet Providers in Ithaca		14850		
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	96.6%	300-1000 Mbps	$49.99-$89.99
Verizon	Fiber	92.8%	300-940 Mbps	$49.99-$89.99
T-Home Internet	5G	48.8%	182 Mbps	$50.00
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
Frontier	DSL	4.2%	NA	$49.99
Clarity Connect	Fixed Wireless	99.3%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	38.1%	6 Mbps	$50.00
Fiberspark	Fiber	9.8%	100-1000 Mbps	$55.00-$80.00
Haefele Connect	Fiber	5.9%	3-250 Mbps	$35.00-$110.00
Spectrum Business	Fiber	100%	1000 Mbps	$164.99
Frontier Business	DSL	17.2%	NA	NA
Kinetic by Windstream Business	DSL	1.7%	100 Mbps	$64.99
Haefele Connect Business	Fiber	26.1%	300 Mbps	NA
CenturyLink Business	Copper	1.2%	NA	NA
FirstLight Business	Fiber	17.2%	NA	NA
Crown Castle Business	Fiber	2.5%	NA	NA
Verizon Business	Copper	1.3%	NA	NA

Summary Of Internet Providers in Ithaca		14853		
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	100%	300-1000 Mbps	$49.99-$89.99
Verizon	DSL	79.8%	15 Mbps	$40.00-$74.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99

HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
T-Home Internet	5G	20.7%	182 Mbps	$50.00
Clarity Connect	Fixed Wireless	100%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	48.8%	6 Mbps	$50.00
Spectrum Business	Cable	100%	1000 Mbps	$49.99-$164.99
Kinetic by Windstream Business	DSL	19.8%	100 Mbps	$64.99
FirstLight Business	Fiber	30.0%	NA	NA

Summary Of Internet Providers in Jacksonville			**14854**	
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	100%	300-1000 Mbps	$49.99-$89.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
OTTC	Fiber	100%	100-1000 Mbps	$59.99-$109.95
Clarity Connect	Fixed Wireless	100%	10 Mbps	$55.00
Spectrum Business	Cable	100%	1000 Mbps	$49.99-$164.99

Summary Of Internet Providers in Newfield			**14867**	
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	78.8%	300-1000 Mbps	$49.99-$89.99
T-Home Internet	5G	58.7%	182 Mbps	$50.00
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
Verizon	DSL	12.7%	15 Mbps	$40.00-$74.99
Clarity Connect	Fixed Wireless	95.0%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	12.8%	6 Mbps	$50.00
Haefele Connect	Fiber	8.7%	3-250 Mbps	$35.00-$110.00
Empire Telephone	DSL	2.2%	10-25 Mbps	$46.98

Spectrum Business	Cable	100%	1000 Mbps	$49.99-$164.99
Haefele Connect Business	Fiber	29.7%	300 Mbps	NA
FirstLight Business	Fiber	0.1%	NA	NA

Summary Of Internet Providers in Slaterville Springs			**14881**	
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	100%	300-1000 Mbps	$49.99-$89.99
T-Home Internet	5G	67.2%	182 Mbps	$50.00
Frontier	DSL	100%	NA	$49.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
Clarity Connect	Fixed Wireless	100%	10 Mbps	$55.00
Spectrum Business	Cable	100%	1000 Mbps	$49.99-$164.99
Frontier Business	DSL	99.8%	NA	NA

Summary Of Internet Providers in Lansing			**14882**	
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	93.3%	300-1000 Mbps	$49.99-$89.99
T-Home Internet	5G	35.2%	182 Mbps	$50.00
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
Verizon	DSL	13.6%	15 Mbps	$40.00-$74.99
Clarity Connect	Fixed Wireless	99.8%	10 Mbps	$55.00
NYSYS airAccess	Fixed Wireless	69.2%	6 Mbps	$50.00
Spectrum Business	Fiber	100%	1000 Mbps	$164.99
Kinetic by Windstream Business	DSL	0.4%	100 Mbps	$64.99
FirstLight Business	Fiber	1.0%	NA	NA

Summary Of Internet Providers in Trumansburg		14886		
Provider	**Type**	**Coverage**	**Speed**	**Pricing**
Spectrum	Cable	60.4%	300-1000 Mbps	$49.99-$89.99
Viasat	Satellite	100%	12-100 Mbps	$49.99-$199.99
HughesNet	Satellite	100%	25 Mbps	$64.99-$159.99
T-Home Internet	5G	23.9%	182 Mbps	$50.00
Verizon	DSL	3.1%	15 Mbps	$40.00-$74.99
Clarity Connect	Fixed Wireless	93.9%	10 Mbps	$55.00
OTTC	Fiber	92.9%	100-1000 Mbps	$59.99-$109.95
NYSYS airAccess	Fixed Wireless	41.9%	6 Mbps	$50.00
Empire Access	Fiber	22.9%	250 Mbps	$50.00
Haefele Connect	Cable	18.8%	10-250 Mbps	$35.00-$110.00
Empire Telephone	Fiber	3.5%	1000 Mbps	NA
Spectrum Business	Cable	100%	1000 Mbps	$49.99-$164.99
Haefele Connect Business	Fiber	25.6%	300 Mbps	NA
Empire Access Business	Fiber	40.9%	1000 Mbps	NA
FirstLight Business	Fiber	8.4%	NA	NA

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Appendix F: ISP Pricing

Tompkins County Provider Website Pricing (Fall of 2022)

Residential

Residential

High-Speed Internet.

$55/month

& a one-time installation fee

Unlimited Data.

No data caps. No throttling. No asterisks or fine print.

Fiber Optic Internet just **$50**/month!

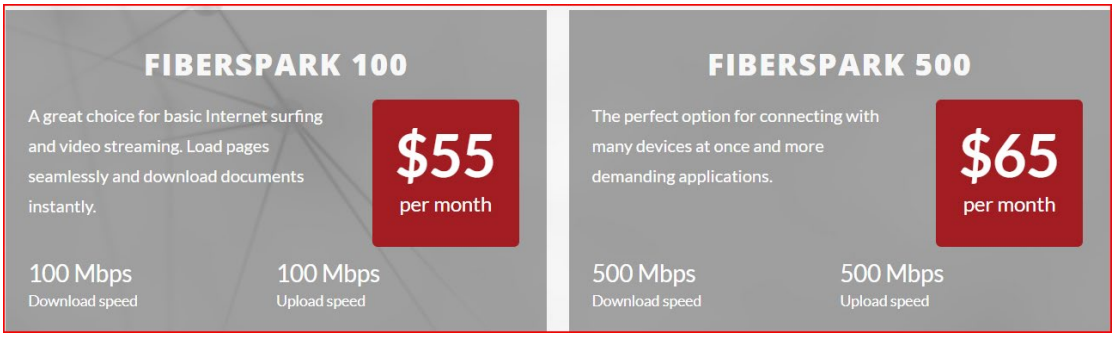
Cheetah DSL ($46.98/mo)

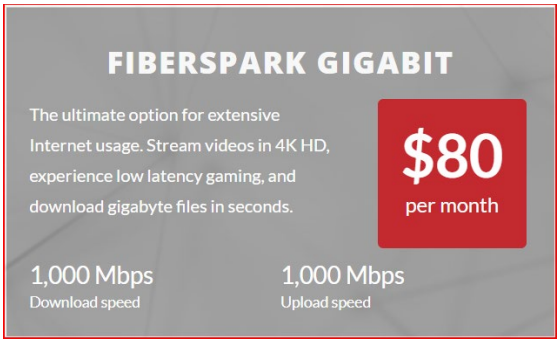
- Up to 10 Mbps Downstream
- Up to 1 Mbps Upstream

FRONTIER
Authorized Sales Agent

$49.99 a month for 12 months w/autopay.

FIBERSPARK





Haefele connect

Fiber to the Home

MiniRocket* starting under	Fiber 150* starting under	Fiber 100* starting under	Fiber 200* starting under
$35/mo	$70/mo	$56/mo	$90/mo
3Mbps Download	$59.95/month when Bundled!	$45.95/month when Bundled!	$79.95/month when Bundled!
1Mbps Upload	150Mbps Download	100Mbps Download	200Mbps Download
100GB/Month Bandwidth	15Mbps Upload	10Mbps Upload	20Mbps Upload
5 Email Accounts	No Data Cap	No Data Cap	No Data Cap

Fiber 250*
OUR FASTEST YET!

Under $110/mo

$99.95/month when Bundled!

250Mbps Download

25Mbps Upload

No Data Cap

MiniConnect	Download speeds up to: **10 Mbps**	Connect 100	Download speeds up to: **100 Mbps**
Haefele connect	**$35**/month Cable	Haefele connect	**$56**/month Cable
	Hide Details • Connection: Cable • Contract: None • Data: 300 GB/mo		Hide Details • Connection: Cable • Contract: None • Data: 1000 GB/mo
Connect 150	Download speeds up to: **150 Mbps**	Connect 200	Download speeds up to: **200 Mbps**
Haefele connect	**$75**/month Cable	Haefele connect	**$90**/month Cable
	Hide Details • Connection: Cable • Contract: None • Data: No Caps		Hide Details • Connection: Cable • Contract: None • Data: No Caps

Connect 250	Download speeds up to: **250 Mbps**
Haefele connect	**$110**/month Cable
	Hide Details • Connection: Cable • Contract: None • Data: No Caps

NYSYS airAccess

Prices start at $50 / monthly

Basic Residential

ottc
ONTARIO & TRUMANSBURG TELEPHONE COMPANIES

ELITE STREAMING	PLATINUM	THE ULTIMATE GIG
100mbps x 100mbps	500mbps x 500mbps	1G x 1G
$59.95/mo.	$79.95/mo.	$109.95/mo.
Enough Speed for ALL Your Devices & Streaming Needs	Run ALL of your Smart Devices with ZERO Buffering	Stream, Game, and Run Your Smart Devices All at Once
No Data Caps No Contracts Installation Fee Waived	No Data Caps No Contracts Installation Fee Waived	No Data Caps No Contracts Installation Fee Waived Managed Wi-Fi Included Download Any Content With No Lag Time

Spectrum Internet®

Spectrum AUTHORIZED RESELLER

Download speeds up to: **300 Mbps**

$49.99/month Cable

Wireless speeds may vary
See offer details.

Hide Details

- Connection: Cable
- Contract: None
- Data: No Caps
- Modem: Modem included.

Spectrum Internet® Ultra

Spectrum AUTHORIZED RESELLER

Download speeds up to: **500 Mbps**

$69.99/month Cable

Wireless speeds may vary.
See offer details.

Hide Details

- Connection: Cable
- Contract: None
- Data: No Caps
- Modem: Modem included.

Spectrum Internet® Gig

Spectrum AUTHORIZED RESELLER

Download speeds up to: **1 Gbps**

$89.99/month Cable

Wireless speeds may vary
See offer details.

Hide Details

- Connection: Cable
- Contract: None
- Data: No Caps
- Modem: Modem included.

Home Internet w/ Autopay

T | HOME INTERNET

Download speeds up to: **182 Mbps**

$50/month Fixed Wireless

Speeds may vary

Hide Details

- Connection: Fixed Wireless
- Contract: None
- Data: No Caps
- Price shown includes taxes + fees
- $50/mo regular rate
- With AutoPay.

High Speed Internet

verizon

Download speeds up to: **15 Mbps**

$40/month DSL

Speeds may vary
See offer details.

Hide Details

- Connection: DSL
- Contract: None
- Data: No Caps

High Speed Internet Enhanced + Freedom Essentials

verizon

Download speeds up to: **15 Mbps**

$74.99/month DSL

Speeds may vary
See offer details.

Hide Details

- Connection: DSL
- Contract: None
- Data: No Caps

Fios 300/300 Mbps Internet

verizon

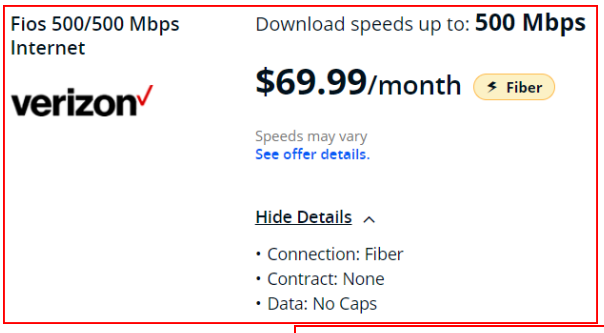
Download speeds up to: **300 Mbps**

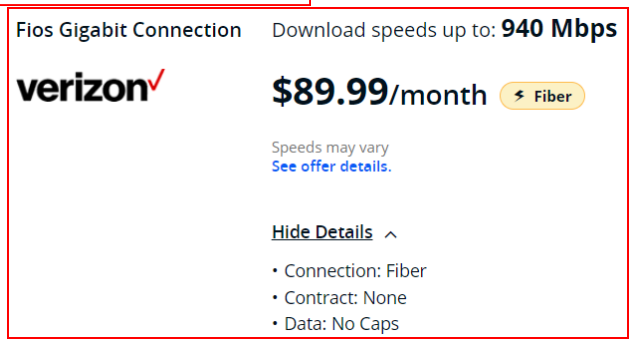
$49.99/month Fiber

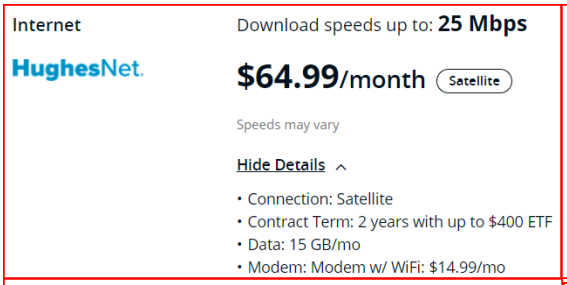
Speeds may vary
See offer details.

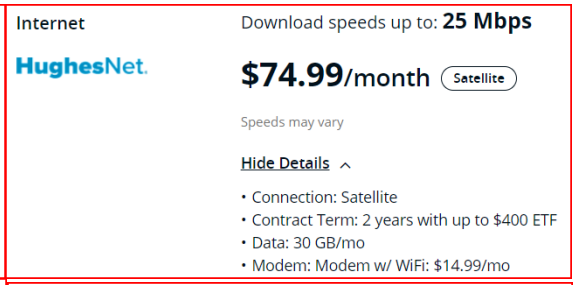
Hide Details

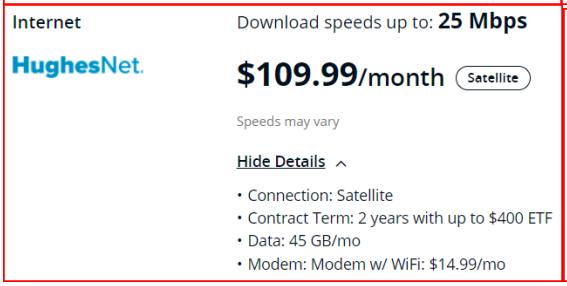
- Connection: Fiber
- Contract: None
- Data: No Caps

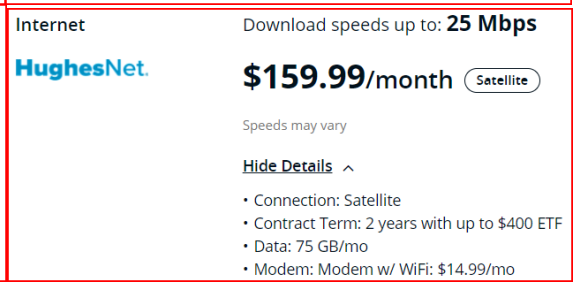

Fios 500/500 Mbps Internet
verizon
Download speeds up to: 500 Mbps
$69.99/month
Fiber
Speeds may vary
See offer details.
Hide Details
• Connection: Fiber
• Contract: None
• Data: No Caps

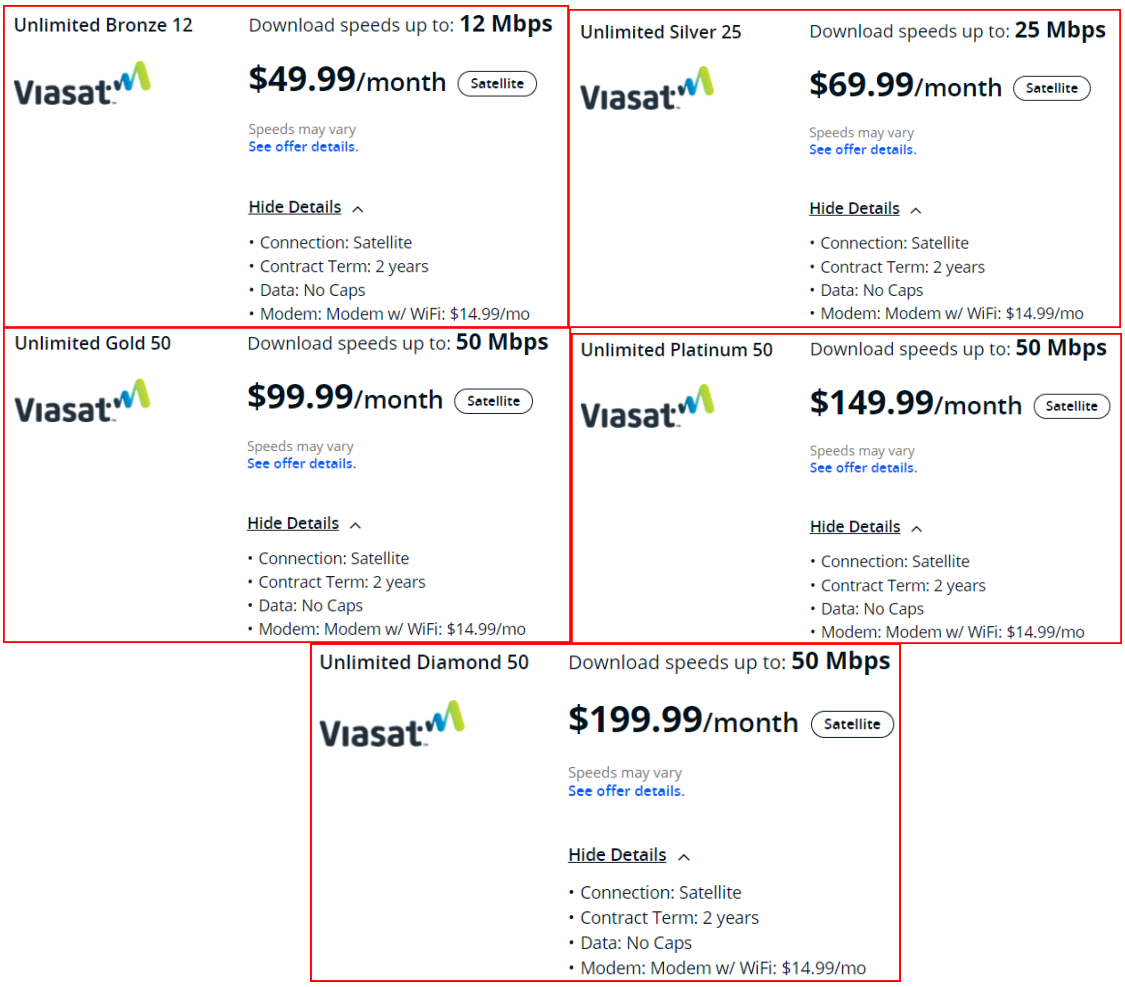

Fios Gigabit Connection
verizon
Download speeds up to: 940 Mbps
$89.99/month
Fiber
Speeds may vary
See offer details.
Hide Details
• Connection: Fiber
• Contract: None
• Data: No Caps


Internet
HughesNet
Download speeds up to: 25 Mbps
$64.99/month
Satellite
Speeds may vary
Hide Details
• Connection: Satellite
• Contract Term: 2 years with up to $400 ETF
• Data: 15 GB/mo
• Modem: Modem w/ WiFi: $14.99/mo


Internet
HughesNet
Download speeds up to: 25 Mbps
$74.99/month
Satellite
Speeds may vary
Hide Details
• Connection: Satellite
• Contract Term: 2 years with up to $400 ETF
• Data: 30 GB/mo
• Modem: Modem w/ WiFi: $14.99/mo


Internet
HughesNet
Download speeds up to: 25 Mbps
$109.99/month
Satellite
Speeds may vary
Hide Details
• Connection: Satellite
• Contract Term: 2 years with up to $400 ETF
• Data: 45 GB/mo
• Modem: Modem w/ WiFi: $14.99/mo


Internet
HughesNet
Download speeds up to: 25 Mbps
$159.99/month
Satellite
Speeds may vary
Hide Details
• Connection: Satellite
• Contract Term: 2 years with up to $400 ETF
• Data: 75 GB/mo
• Modem: Modem w/ WiFi: $14.99/mo



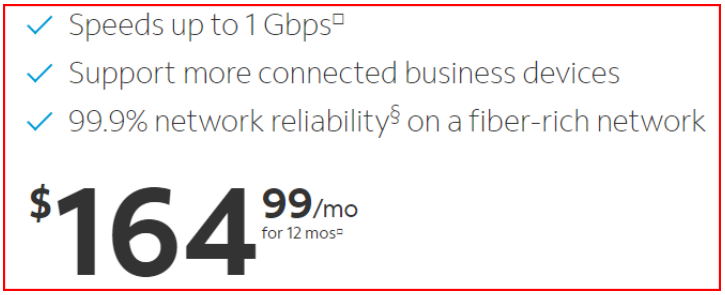
Business

kinetic business by windstream

High Speed

25 MBPS	$64.99/MO
50 MBPS	$64.99/MO
100 MBPS	$64.99/MO

Fiber



High Speed

Appendix G: FCC Technology Codes

Technology Codes Used in Form 477 Fixed Broadband Deployment Data

Below is a list of 2-digit technology codes used in the FCC Form 477 data and their associated technologies. The technologies indicate the portion of the Internet access connection that terminates at the end user's location (premises).

Code	Technology of Transmission
10	Asymmetric xDSL (Up to 8.1Mbps/896 Kbps)
11	ADSL2, ADSL2+ (Up to 12 Mbps/1 Mbps, 24 Mbps/1 Mbps)[10]
12	VDSL
20	Symmetric xDSL*
30	Other Copper Wireline (all copper-wire based technologies other than xDSL; Ethernet over copper and T-1 are examples)
40	Cable Modem other than DOCSIS 1, 1.1, 2.0, 3.0, or 3.1
41	Cable Modem – DOCSIS 1, 1.1 or 2.0
42	Cable Modem – DOCSIS 3.0
43	Cable Modem – DOCSIS 3.1
50	Optical Carrier / Fiber to the end user (Fiber to the home or business end user, does not include “fiber to the curb”)
60	Satellite
70	Terrestrial Fixed Wireless
90	Electric Power Line
0	All Other

10 Difference Between ADSL2 and ADSL2+ (ADSL2 Plus) | Compare the Difference Between Similar Terms

Appendix H: Glossary

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.

8 bits equal one byte of data – a byte is generally the same as one character – for example, the letter "a."

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.

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.

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.

DSL (Digital Subscriber Line). DSL is 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.

DOWNLOAD SPEED. The rate at which data is transferred from the Internet to the user's computer is termed download speed. This speed is typically stated in Megabits (1,000,000 bits) per second or Gigabits (1,000 Megabits) per second.

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 remarkably 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.

INCUMBENT LOCAL EXCHANGE CARRIER (ILEC). An ILEC is the local telephone company that provides service to business, organizations, and residences 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 on 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 a house is considered a “last mile” connection.

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.

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. 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.

UPLOAD SPEED. The rate at which data is transferred from the user’s computer to the Internet is termed upload speed. This speed is typically stated in Megabits (1,000,000 bits) per second or Gigabits (1,000 Megabits) per second.

WAN. (Wide Area Network) WAN is used to extend LAN connectivity beyond a city or County, usually through common carrier facilities.

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.