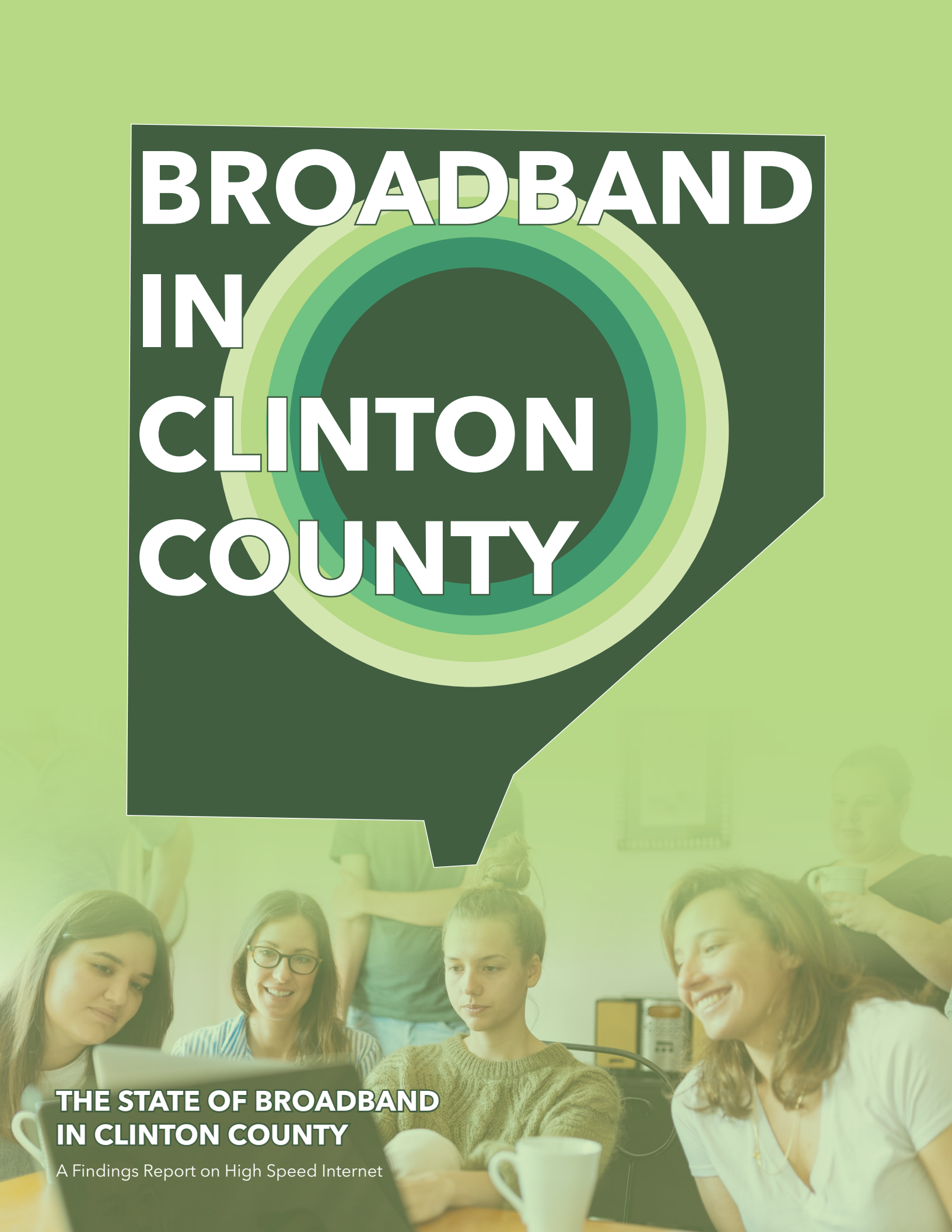# BROADBAND IN CLINTON COUNTY

THE STATE OF BROADBAND IN CLINTON COUNTY

A Findings Report on High Speed Internet

EXECUTIVE SUMMARY

The purpose of this paper is to investigate the current state of broadband in Clinton County, Ohio, to define broadband and the categories of coverage that exist within Clinton County, to identify gaps in coverage, and to explore County, Regional, State and National initiatives that exist to assist in expanding broadband service. This paper will explore challenges that need to be addressed within broadband infrastructure in Clinton County, identify specific resources and strategies that can improve broadband, cite rural case studies regarding broadband expansion, and lastly, there are suggestions to improve broadband access for all residents of Clinton County.
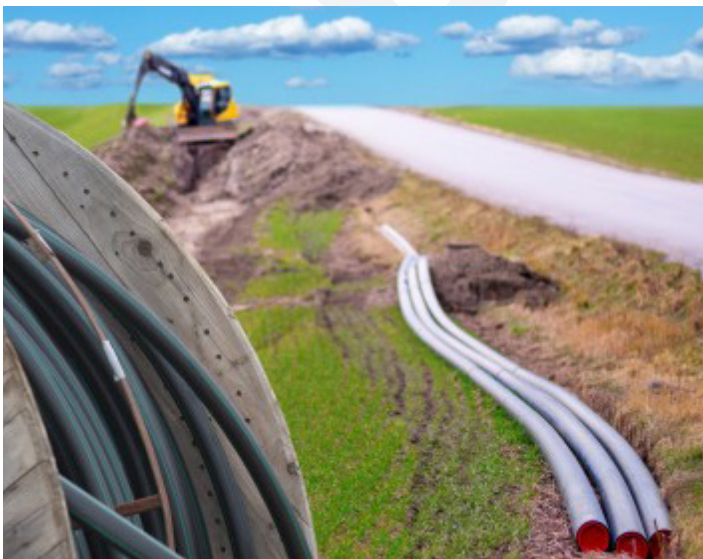
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THE NEED FOR BROADBAND

Access to broadband is more important today than ever before. Many leaders equate rural broadband development to rural electrification. In the 1930s, electricity was common in American cities, however only about 11.6 percent of farms had electricity. In just four years with the passing of the 1936 Rural Electrification Act, the number of farms with electricity expanded to 25 percent. Today, broadband access is available to only 65 percent of rural areas as compared to 98 percent of urban areas. There are quite a few differences between rural broadband expansion and rural electrification, such as program structure and deployment costs. However, rural areas must develop broadband access to provide equity and to catch up with current technology.

On the individual level, broadband is required for educational streaming and assignments for public schools and universities, healthcare communication for doctor-to-patient virtual visits (tele-health), entertainment streaming (movies,shows, and sports), general information searches, and is an essential utility for employees working from home. On the larger level, broadband access is a key factor for business attraction and development to rural areas. Clinton County has a responsibility to provide appropriate infrastructure to county residents in order to move forward in step with the technological growth of the rest of the nation, as well as the world. The county needs to consider the rapid change of technology and invest in long lasting methods of broadband access, such as fiber. Access to broadband is an issue of equity: the financial strain for broadband companies to expand network availability, currently works against the needs of the public. The lack of access is causing a technological divide. As of March 2020, during the Covid-19 outbreak, broadband provider Cincinnati Bell documented a 50% increase in bandwidth consumption during daytime hours, with many workers at home relying upon broadband for their careers. The coronavirus has illuminated the inequities and need for broadband access for every home in Clinton County.

Broadband is crucial infrastructure. It should be treated as other systems of infrastructure that support our community, such as phone and electrical lines, sewer, roadways, and water. Similar to broadband, these physical systems provide an ease of living and convenience, as well as necessary means of communicating and safety.

https://cfaes.osu.edu/news/articles/cfaes-report-focuses-ways-increase-rural-access-broadband-internet-in-ohio

HOW BROADBAND IS DEFINED

The term broadband refers to high-speed internet access that is always on, and is faster than dial-up access. The minimum standard for broadband as defined by the Federal Communications Commission (FCC) is 25Mbps (megabits per second) download speed and 3 Mbps upload speed. Broadband includes several high-speed transmission technologies:

Digital Subscriber Line (DSL), ADSL, SDSL, Cable modem, Wireless, Satellite, and BPL. The following definitions are drawn from the Federal Communications Commission.

CATEGORIES OF BROADBAND SPEEDS

Megabits per second is how internet bandwidth is measured. Categories of broadband are divided into megabits per second (Mbps): 10, 25, 50, 100. Speed under 10 Mbps is considered "unserved" by Connected Nation's standards, because the rate is nearly too slow to be of effective use. The minimum standard for broadband as defined by the Federal Communications Commission is 25Mbps (megabits per second) download speed and 3 Mbps upload speed.

HURDLES OF BROADBAND: MAPPING ACCURACY AND MARKET MONOPOLY

MAPPING ACCURACY

At the federal level there are bills in review to change the way that data is obtained regarding broadband access. Currently, it is based upon census blocks, which overlooks caveats in the services provided. For example, if one home on a road can get broadband service, but a mile away their neighbor cannot receive broadband because of the provider's limitations, the current maps provided by the Federal Communications Commission do not show this. It is therefore assumed that an entire road, or a majority of it, has access to broadband when in fact it does not. The current maps illustrate the area as receiving broadband, since one house or a few houses are able to receive service. This requires recreating existing maps that use census blocking with layers of more granular information, filtering in broadband data and internet use on a house by house basis.

MONOPOLY

According to Connected Nation, 64% of households say they only have one company to choose from, in order to receive broadband. If affordability is the concern, there are special programs that Connected Nation promotes through companies such as Spectrum and Comcast that offer steep discounts to families in a low-income bracket, in order to supply their homes with broadband at a fraction of the market cost. Given that every household today has an average of nine technological devices, the use of broadband is at a high demand. Particularly low income and rural Americans are left with little to no choice for a service they need.

BROADBAND DEFINITIONS

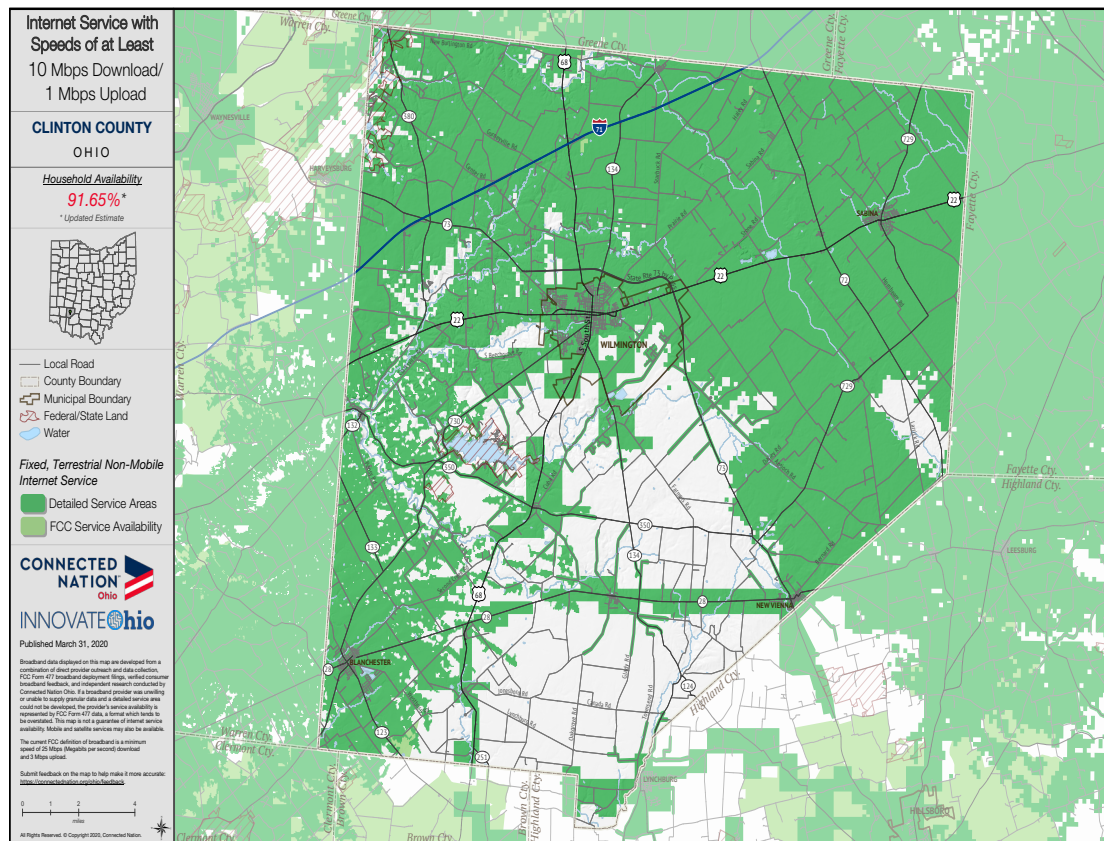|	
DIGITAL SUBSCRIBER LINE (DSL)	DSL is a wireline transmission technology that transmits data faster over traditional copper telephone lines already installed to homes. HDSL and VDSL are high-speed digital subscriber DSL connections, typically for businesses use.
ASYMMETRICAL DIGITAL SUBSCRIBER LINE (ADSL)	Used primarily by residential customers, such as Internet surfers, who receive a lot of data but do not send much. The "asymmetrical" refers to this greater download speed and reduced upload speed.
SYMMETRICAL DIGITAL SUBSCRIBER LINE (SDSL)	Used by businesses for services such as video conferencing. This line uses significant bandwidth for both upstream and downstream, meaning the speed of service is similar for both downloads and uploads.
CABLE MODEM	Most cable modems are external devices that have two connections: one to the cable wall outlet, the other to a computer. They provide transmission speeds of 1.5 Mbps or more.
FIBER	Fiber optic technology converts electrical signals (carrying data) to light, and sends the light through narrow, transparent glass fibers. Fiber transmits data at faster speeds, far exceeding current DSL or cable modem speeds, typically by tens or even hundreds of Mbps. Fiber is often buried in the ground and runs to the customer's home or to the curbside.
WIRELESS	Wireless broadband connects a home or business to the internet using a radio link between the customer's location and the service provider's facility. Wireless broadband can be mobile or fixed. Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas (where DSL or cable modem service would be expensive). An external antenna is usually required.
SATELLITE	Satellite is useful for serving rural areas where houses are spread far apart. It requires hardware including a satellite dish antenna and a transmitter / receiver that operates in the microwave portion of the radio spectrum. Downstream and upstream speeds for satellite broadband depend on several factors, including the provider or service package purchased, the consumer's line of sight to the orbiting satellite, and even weather.
BROADBAND OVER POWERLINES	Delivery of broadband over the existing low and medium voltage electric power distribution network. Speeds are comparable to DSL and cable modem speeds. BPL can be provided to homes using existing electrical connections and outlets. BPL is available in very limited areas. It has significant potential because power lines are installed virtually everywhere, alleviating the need to build new broadband facilities for every customer.

EXISTING COVERAGE IN CLINTON COUNTY

To get a better understanding of broadband coverage in the county, a nonprofit organization named Connected Nation provides county-wide maps displaying broadband coverage based on internet speeds. Connected Nation works to help communities close their technology gaps. The existing coverage of broadband in Clinton County is relatively strong in the city limits of Wilmington at 50mbps to 100mbps. Access to higher speeds outside of Wilmington's city limits dissipates to either 10mbps or no service at all (see map below). Connected Nation's broadband availability map of Clinton County illustrates that 66.15% of households have high internet speeds of 50 to 100 mpbs. However, 71.6% of households in Clinton County have broadband available at a speed of 25 mbps download and 3 mpbs upload per second. Though a lower broadband speed is more widely accessible throughout the county, 25/3 mpbs per second is far from sufficient. Even though there is a broadband connection available in a certain location, it does not mean that the service speed is high enough to use effectively. For example, 91.65% of households in Clinton County have broadband availability at a very low 10 mbps per second, compared to the aforementioned 66.15% that have broadband available at a faster rate. It appears that there is extensive broadband access, however, rural residences outside of Wilmington city limits or outside of villages face dismal broadband options. Over one quarter of households still require basic access to any broadband service (25 mpbs download and 3 mpbs upload), and even more homes need better service. It is vital to look at upload speeds for households who have multiple users working remotely, accessing telemedicine, or attending school virtually. For these uses, an upload speed of 3 mpbs is not enough for a household.

It is important to note that the household numbers in more dense areas have better service because broadband companies want the business of a condensed customer base. Since there are fewer homes on rural roads, those homes are not being serviced and Clinton County's geographical broadband coverage is severely lacking.

The primary issue of broadband access is the cost of installation for companies to supply broadband to rural consumers. The return on investment is not as high for companies in rural areas. Currently, a home in Wilmington can receive broadband for as low as $30-35 a month, while a home in rural Clinton County typically pays $79-100 monthly. Families that live in less dense regions of the county pay three times more monthly for a service that is likely not as strong. Companies providing broadband will not provide services without seeing a return on investment satisfied. This leads to high prices for less dense areas. Until there is funding to provide broadband to access to rural areas, they will continue to lag in technology.
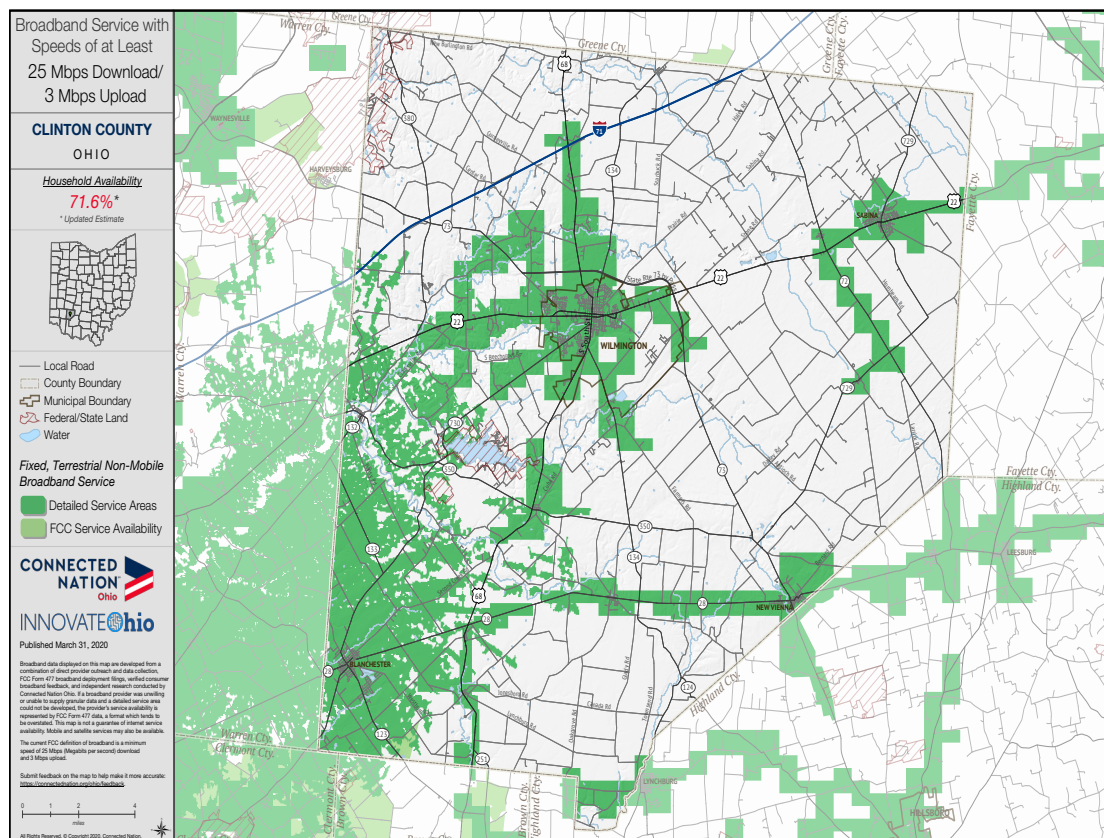
EXISTING BROADBAND SERVICE SPEEDS IN CLINTON COUNTY
## ACCORDING TO 2018 CENSUS DATA, COMPILED BY CONNECTED NATION

Internet Service with Speeds of at Least
10 Mbps Download/
1 Mbps Upload

CLINTON COUNTY
OHIO

Household Availability
91.65%*
* Updated Estimate

— Local Road
County Boundary
Municipal Boundary
Federal/State Land
Water

Fixed, Terrestrial Non-Mobile Internet Service
Detailed Service Areas
FCC Service Availability

CONNECTED NATION Ohio
INNOVATEOhio

Published March 31, 2020

10 Mbps Download Speed, 1 Mbps Upload Speed in Clinton County

internet speed is substantially below recommended minimum speeds

Broadband Service with Speeds of at Least
25 Mbps Download/
3 Mbps Upload

CLINTON COUNTY
OHIO

Household Availability
71.6%*
* Updated Estimate

— Local Road
County Boundary
Municipal Boundary
Federal/State Land
Water

Fixed, Terrestrial Non-Mobile Broadband Service
Detailed Service Areas
FCC Service Availability

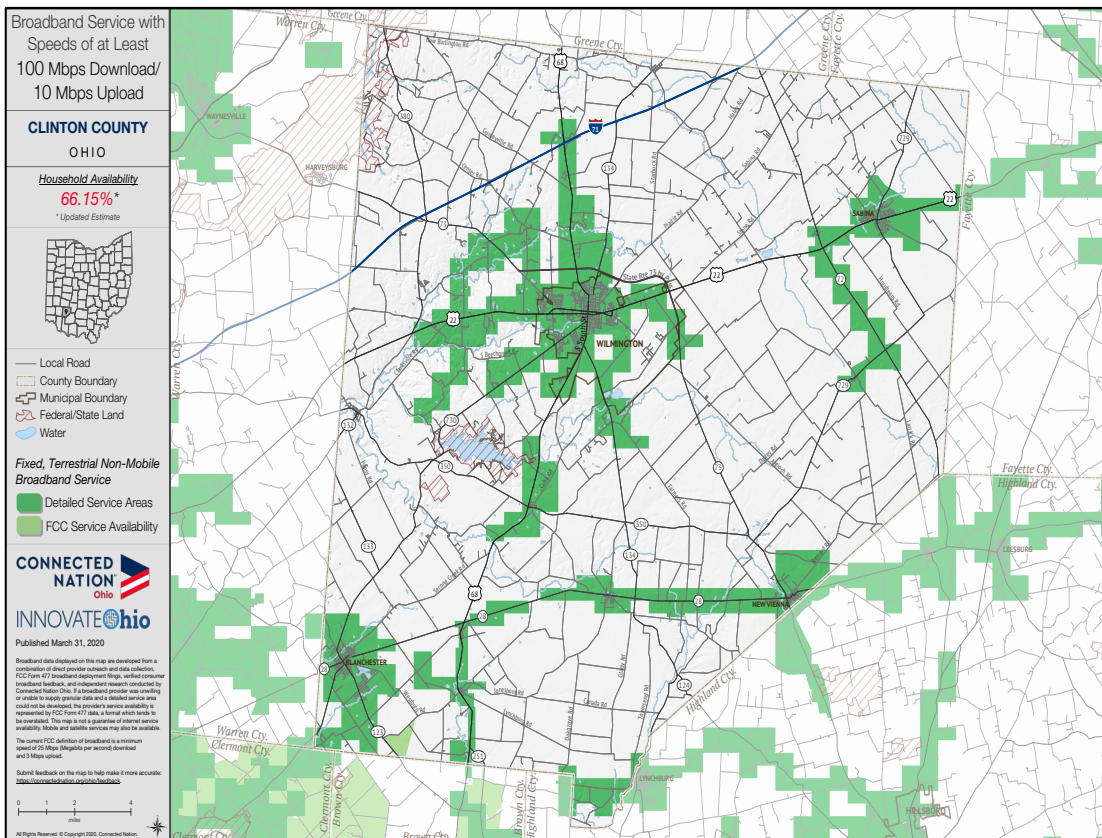CONNECTED NATION Ohio
INNOVATEOhio

Published March 31, 2020

25 Mbps Download Speed, 3 Mbps Upload Speed in Clinton County

Federal Communication Commission recommended minimum internet speed
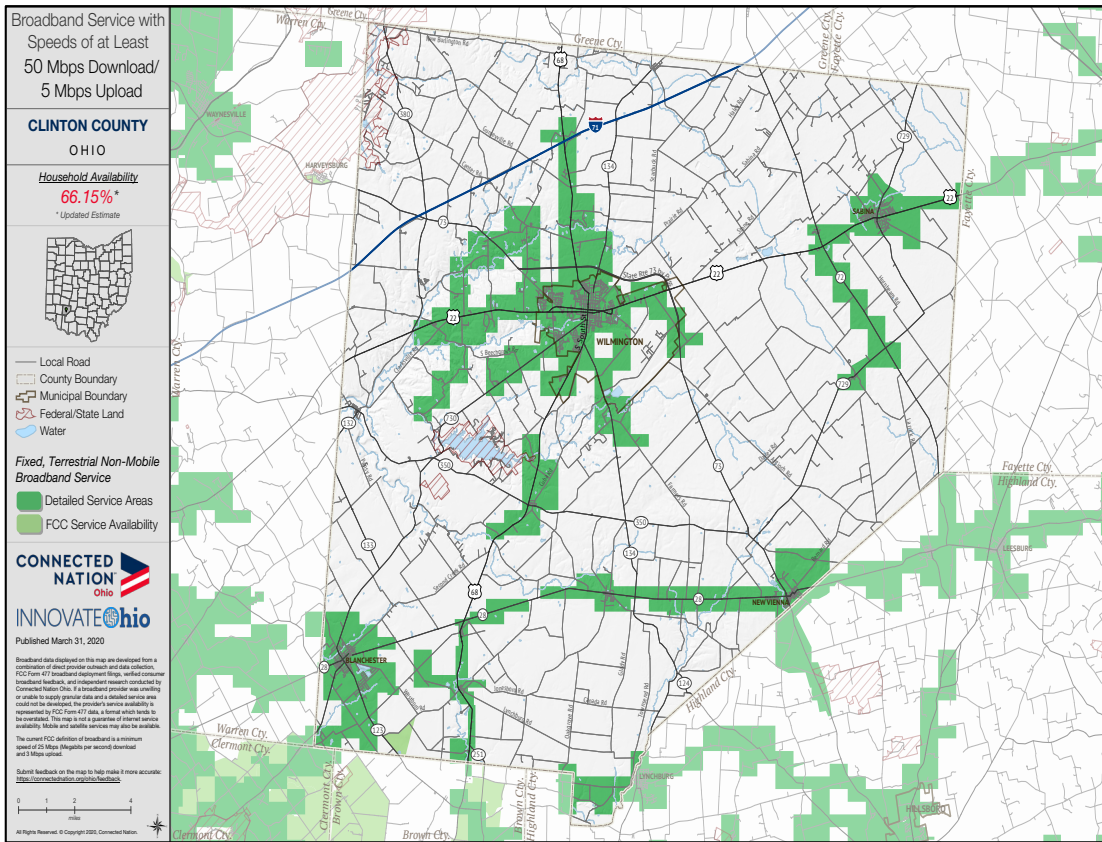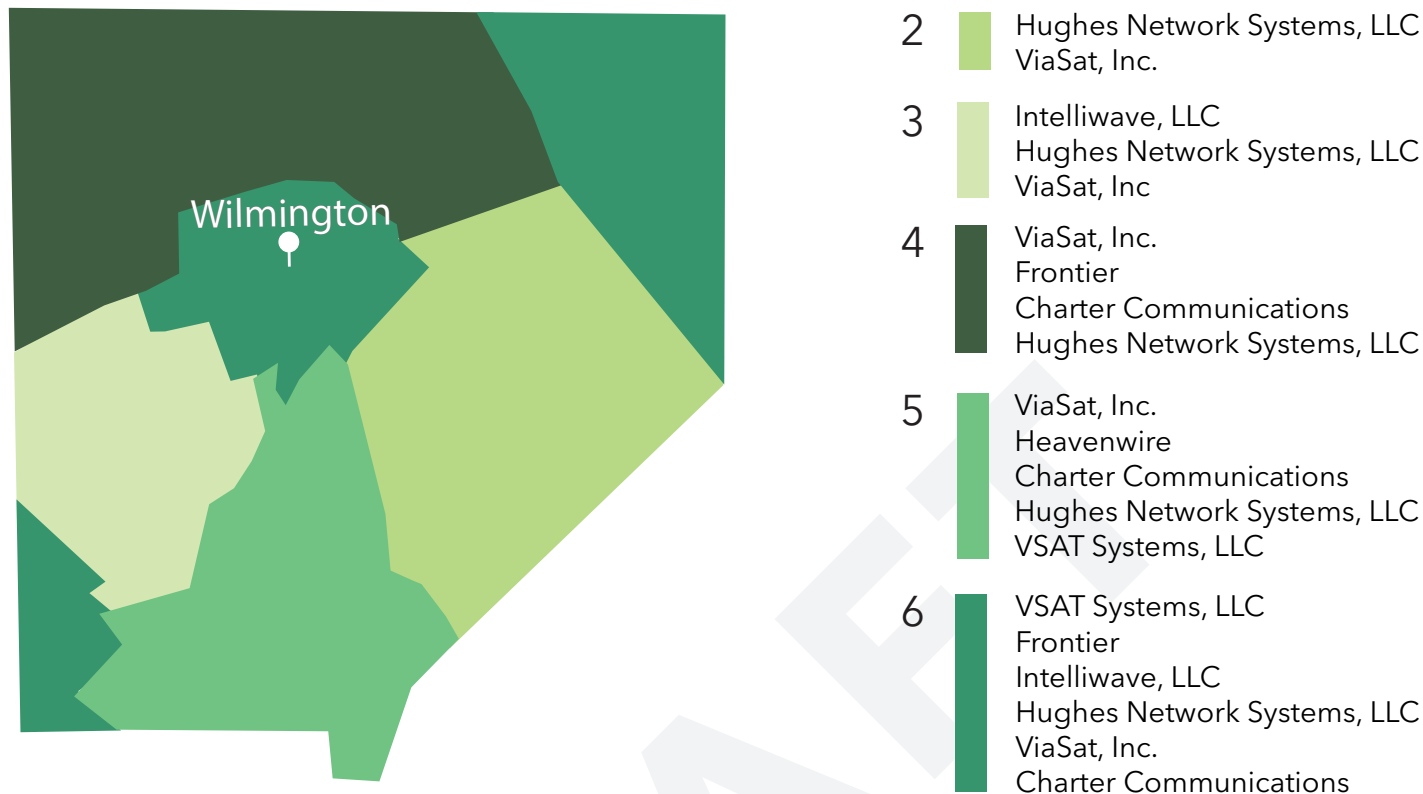
50 Mbps Download Speed,
5 Mbps Upload Speed in
Clinton County

100 Mbps Download
Speed,
10 Mbps Upload Speed in
Clinton County

*internet speed sufficient
for a multiple user
household*

NUMBER OF BROADBAND PROVIDERS AVAILABLE BY AREA

Wilmington

2
Hughes Network Systems, LLC
ViaSat, Inc.

3
Intelliwave, LLC
Hughes Network Systems, LLC
ViaSat, Inc

4
ViaSat, Inc.
Frontier
Charter Communications
Hughes Network Systems, LLC

5
ViaSat, Inc.
Heavenwire
Charter Communications
Hughes Network Systems, LLC
VSAT Systems, LLC

6
VSAT Systems, LLC
Frontier
Intelliwave, LLC
Hughes Network Systems, LLC
ViaSat, Inc.
Charter Communications

Data source: broadbandmap.fcc.gov and 2018
Census infographic by Brigitta Mills

BROADBAND PROVIDERS IN CLINTON COUNTY

The map above displays the number of broadband providers available by area in Clinton County. The map shows the more populous the area, the more likely there will be more broadband providers available for residents. The areas with six available providers includes the City of Wilmington, the Village of Blanchester, and the Village of Sabina. The more rural parts of the county have less providers available. The series of maps on page 11 display the broadband providers used by residents in the county. Each map shows the area described and lists each provider that is used by residents to the corresponding area.
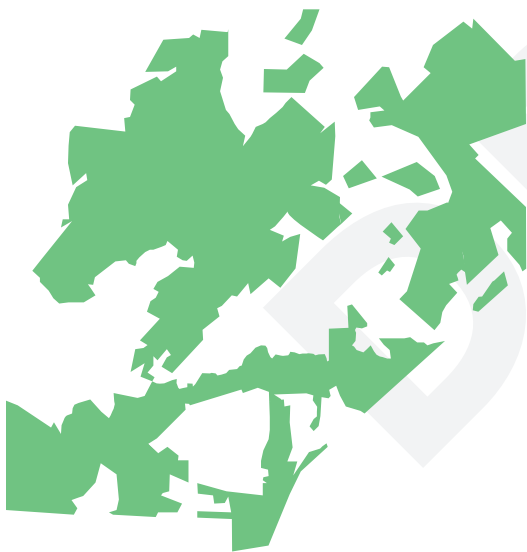
BROADBAND PROVIDERS USED BY AREA
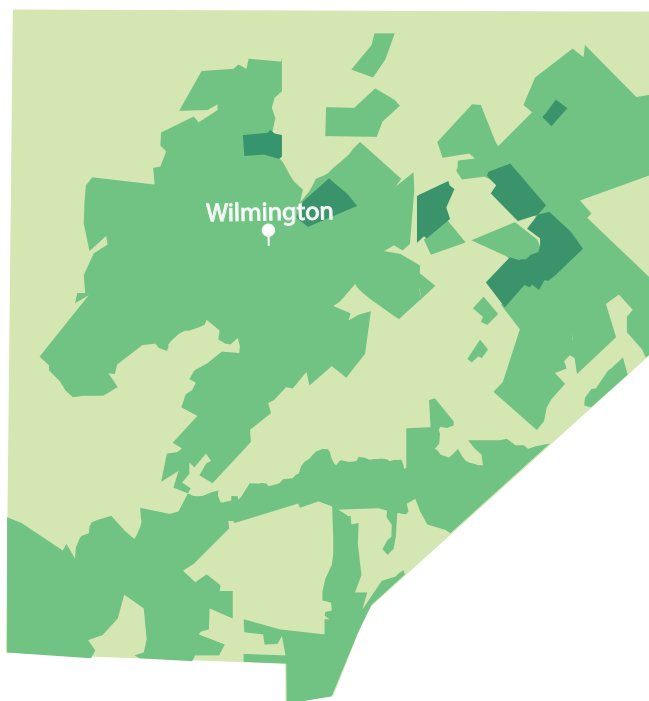
FCC Fixed Broadband Deployment, Federal Communications Commission , 2018, broadbandmap.fcc.gov/.
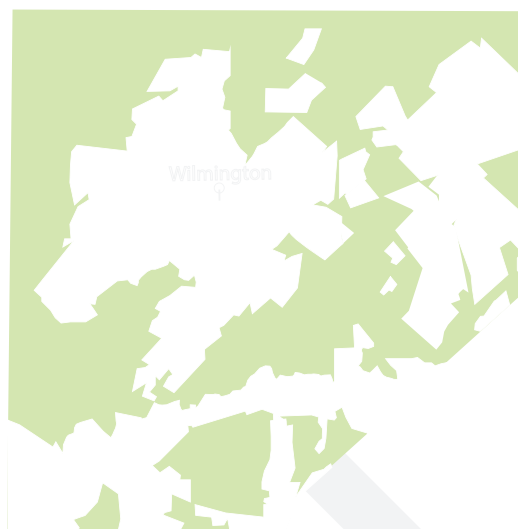
Frontier Communications Corporation - ADSL
Hughes Network Systems, LLC - satellite
ViaSat, Inc. - satellite
VSAT Systems, LLC - satellite

Frontier Communications Corporation - ADSL
Hughes Network Systems, LLC - satellite
ViaSat, Inc. - satellite
Charter Communications - cable
VSAT Systems, LLC - satellite
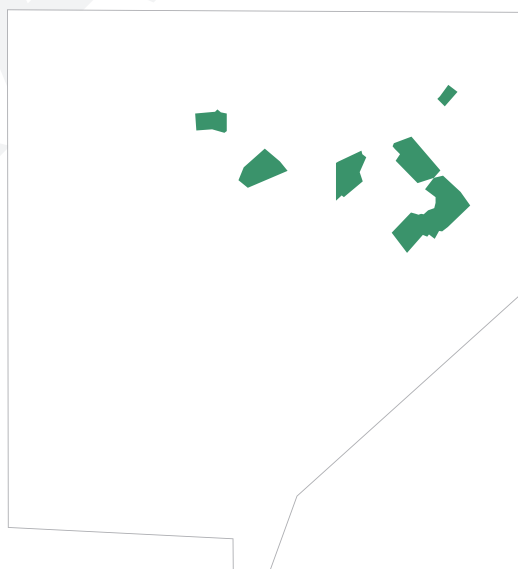
Charter Communications - cable
ViaSat, Inc. - satellite
Intelliwave, LLC - fixed wireless
Hughes Network Systems, LLC - satellite
Frontier Communications Corporation - ADSL
VSAT Systems, LLC - satellite

CLINTON COUNTY BROADBAND SUBSCRIBERS WITH INTERNET SUBSCRIPTION THROUGH SATELLITE
by Census Block Groups*

Legend scale: 0% 6.5% 12.9% 19.4% 25.8% 32.3%

Map labels:
- 21% / 187
- 10.6% / 34
- 19.8% / 48
- 7.6% / 25
- 12.8% / 65
- 3.2% / 13
- 19.7% / 151
- 7.5% / 84
- 0% / 0
- 0% / 0
- 14.8% / 55
- 1.8% / 6
- 4.6% / 21
- 1.7% / 7
- 3.6% / 27
- 6.7% / 23
- 0% / 0
- 14.5% / 51
- 10.9% / 96
- 14.5% / 99
- 7.6% / 45
- 10.6% / 78
- 2.9% / 7
- 6.7% / 23
- 7.9% / 26
- 4.7% / 11
- 2.6% / 18
- 3.9% / 17
- 4.1% / 16
- 2.6% / 16
- 32.3% / 45

Each outline represents a census block. Percentage indicates households within census block group using satellite.
This number is variable by 2 - 15% based upon census block.

The number below percentage indicates the number of households claiming satellite usage within that particular census block.

*Block Groups (BGs) are statistical divisions of census tracts, are generally defined to contain between 600 and 3,000 people, and are used to present data and control block numbering. A block group consists of clusters of blocks within the same census tract that have the same first digit of their four-digit census block number.
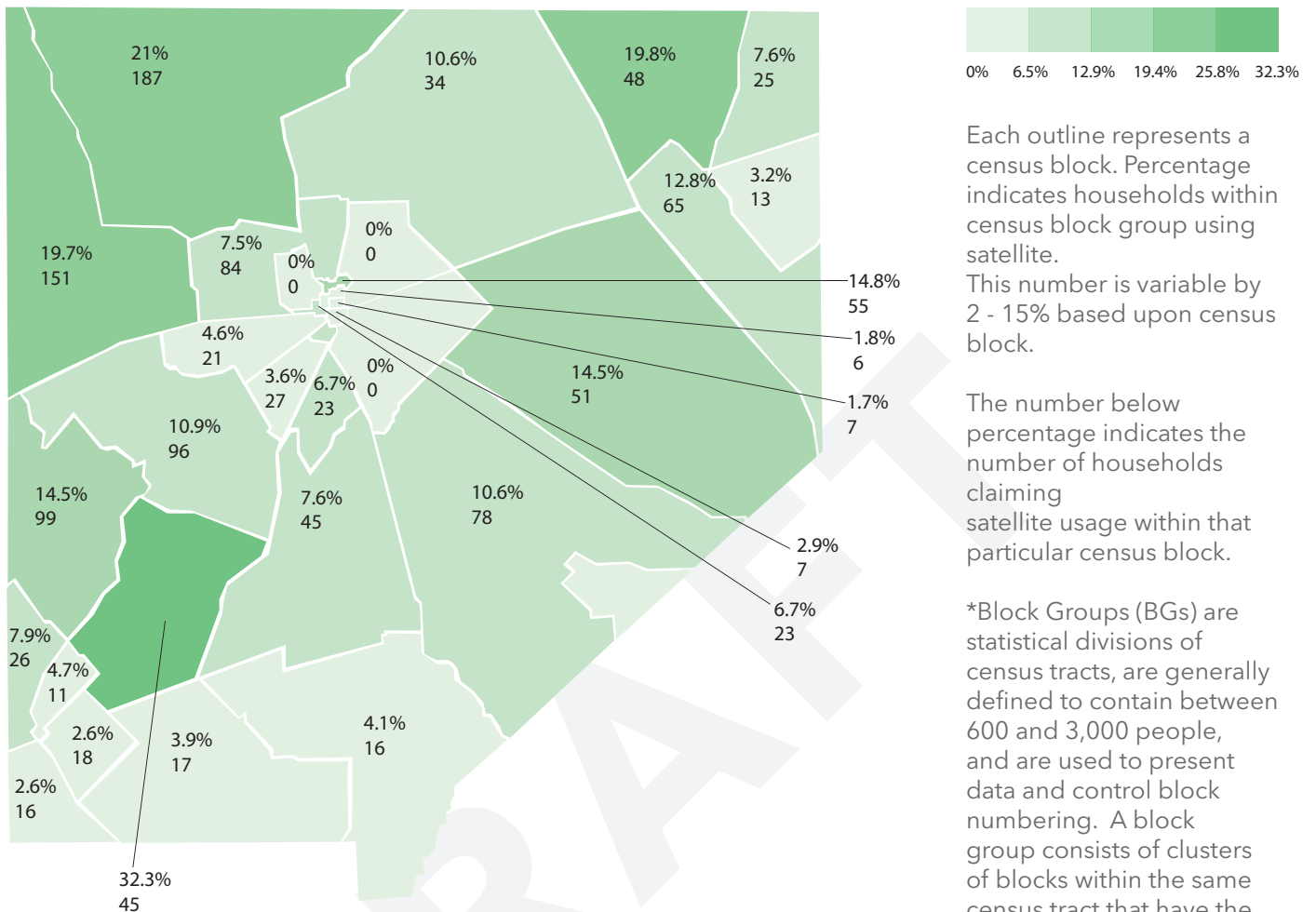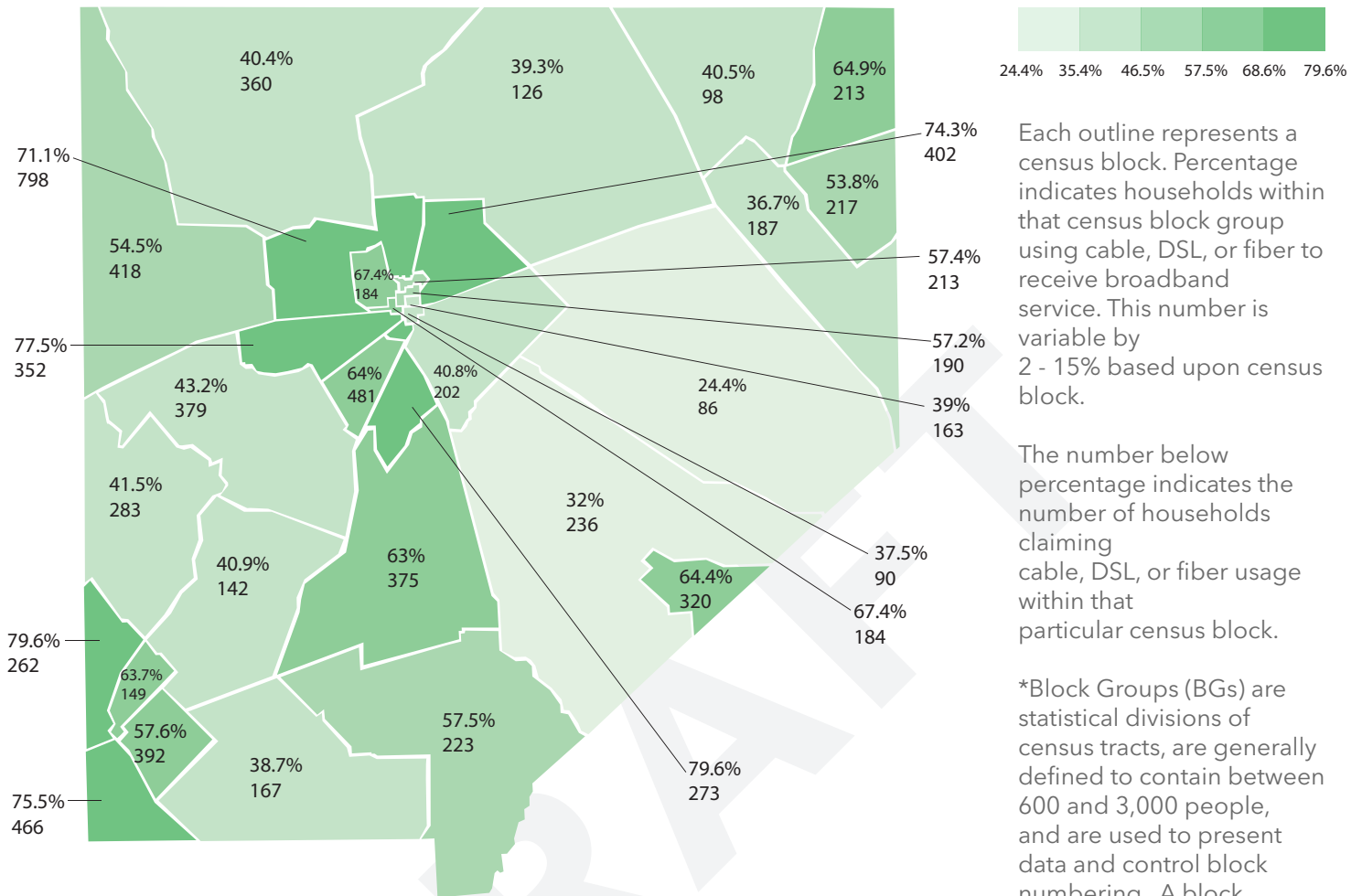
Image and Data Source: U.S. Census Bureau (2014-2018). Presence and Types of Internet Subscriptions in Household American Community Survey 5-year estimates. Retrieved from <https://censusreporter.org>

BROADBAND ACCESS TYPES

According to maps from the American Communities Survey, more rural areas in the county access broadband through internet subscriptions via satellite. However, more populous areas in the county access broadband through internet subscriptions via cable, DSL, and fiber. Residents and businesses who are able to access broadband through cable, DSL, and fiber typically have much faster internet speeds than those who access broadband through satellite. These maps help to display the disparity in internet speeds even within the county.

CLINTON COUNTY BROADBAND SUBSCRIBERS
WITH INTERNET SUBSCRIPTION THROUGH CABLE, DSL, FIBER
by Census Block Groups*

Legend: 24.4% 35.4% 46.5% 57.5% 68.6% 79.6%

Each outline represents a census block. Percentage indicates households within that census block group using cable, DSL, or fiber to receive broadband service. This number is variable by 2 - 15% based upon census block.

The number below percentage indicates the number of households claiming cable, DSL, or fiber usage within that particular census block.

*Block Groups (BGs) are statistical divisions of census tracts, are generally defined to contain between 600 and 3,000 people, and are used to present data and control block numbering. A block group consists of clusters of blocks within the same census tract that have the same first digit of their four-digit census block number.

Image and Data Source: U.S. Census Bureau (2014-2018). Presence and Types of Internet Subscriptions in Household American Community Survey 5-year estimates. Retrieved from <https://censusreporter.org>

CURRENT STRATEGIES TO IMPROVE BROADBAND ACCESS: FEDERAL AND REGIONAL

Due to the steep cost of new broadband installation in rural regions, creative funding partnerships and grants exist to assist with the installation of broadband. Public - private partnerships have the potential to immensely impact broadband service gaps. Statistically, gaps in coverage are due to low population in an area where providers are not willing to provide broadband. Funds in communities are starting to be designated for technological advancement, such as broadband installation. Rural opportunity funds from the federal level provide unserved areas with broadband, when partnered with local funds. In most cases, for companies such as Cincinnati Bell, Spectrum or Intelliwave, to tackle investing in a rural area with a small population of consumers, there needs to be a public - private partnership to make the broadband infrastructure financially feasible.

FEDERAL INITIATIVES

Due to the increasing use of broadband across the United States, the government has begun to establish funds for which communities in rural areas can apply. Grants are offered through the Federal Communications Commission, the United States Department of Agriculture, and Broadband USA. Specific grants offered at the federal level are listed below.

CONNECT AMERICA FUND BY THE FEDERAL COMMUNICATIONS COMMISSION

The Connect America Fund (CAF) is an arm of the Federal Communications Commission which aims to expand broadband access to rural regions. The CAF program has given over 1.49 billion dollars over the past ten years to provide fixed broadband to over 700,000 locations in 45 states. This program is particularly designed to ensure that customers in rural, insular or high-cost areas can have broadband service comparable to densely populated areas.

BROADBAND USA

Broadband USA is the National Telecommunications and Information Administration's project to expand broadband accessibility. NTIA has invested $4 billion in projects throughout the United States to support broadband infrastructure, enhance and expand public computer centers, encourage sustainable adoption of broadband service. In Ohio, NTIA's grants have funded Connect Ohio's efforts, and Com Net's GigE Plus, and Horizon TeleCom Fiber, OneCommunity, ZitoMedia - all broadband infrastructure based projects in Ohio.

"RECONNECT" COMMUNITY GRANT BY THE UNITED STATES DEPARTMENT OF AGRICULTURE

This program helps fund broadband deployment into rural communities where it is not yet economically viable for private sector providers to deliver service. Eligible areas include: rural areas that lack any existing broadband speed of at least 10 Mbps downstream and 1 Mbps upstream are eligible. Funds help cover construction, acquisition, leasing of facilities, and any buildings used to deploy broadband service. Additionally, less than 10% of the grant amount, or up to $150,000, may be used for the improvement, expansion, construction or acquisition of a community center that provides online access to the public in the funded service area.

REGIONAL INITIATIVES

The Ohio Legislature has proposed House Bill 13 and 190, by representatives Carfagna, O'Brien, and Smith, regarding rural broadband as of March 2020. The legislation proposes to establish a rural broadband expansion program within Ohio and provide specific resources. This is intended to provide a $20 million dollar budget to broadband infrastructure build-out throughout Ohio. House Bill 13 and 190 are still in committee as of September 2020.

The following grant programs and funding sources encourage the expansion of broadband infrastructure in Ohio, intended to help Ohio specifically in becoming technologically current. More information regarding Broadband Ohio, DOT's Tiger Grant, the FCC's ERate Program, and OARnet, can be found below.

BROADBAND OHIO

As of March 2020, the Innovate Ohio program expanded their plan in the state of Ohio to address internet resources more intensely. This plan, led by the DeWine - Husted administration, includes developing funding streams for rural communities in Ohio, as well as broadband grants for communities to apply for in order to install or enhance broadband infrastructure. The initiative is aimed at assisting the unserved and underserved population across Ohio. This office also serves as a liaison between state agencies and Ohioans, as well as a resource for local governments as expansion of broadband begins. Peter Voderberg is the recently-selected Chief of the Broadband Ohio office.

E-RATE PROGRAM SUBSIDIES FOR BROADBAND ACCESS

The Federal Communication Commission's E-Rate Program makes telecommunications and information services more affordable for schools and libraries. With funding from the Universal Service Fund, E-Rate provides discounts for telecommunications, internet access, and internal connections to eligible schools, and libraries.

DEPARTMENT OF TRANSPORTATION TIGER GRANT

The expansion of fixed and mobile broadband will enable transportation and public well being to be better addressed with expanded broadband access. For example, the general public will more easily be able to access the public transit systems' on-line service; will enable human service agencies to more efficiently coordinate; will enable communications services that rely on broadband connectivity to realize immediate improvement.

## OARNET INFRASTRUCTURE PROJECT

OARnet, a division of the Ohio Department of Higher Education's Ohio Technology Consortium, aims to increase access to affordable broadband service. OARnet's fiber-optic backbone stretches more than 2,400 miles, thereby lowering broadband access cost. By centralizing technology hardware, software, and network requirements needed to support the overall community, OARnet reduces the cost of service delivery. Offerings include a network operations center, co-location, emergency web hosting, and cloud computing for education and research institutions.

RURAL BROADBAND: AGRICULTURE DEMANDS IT

Today, farming in Clinton County looks different than it did a generation ago. From using the internet to check farm reports daily, researching technical issues on the farm, advertising crops, keeping track of inputs, procurement of seed or equipment, to hiring help. There are also wireless applications and IoT (Internet of Things) applications that allow farmers to monitor livestock health and location on property for assistance in managing a farm. With the use of a broadband network, data regarding livestocks, machines, and other objects have unique identifiers that transfer data to a receiver. Farming today is at an unprecedented frontier of precision, information sharing, and control, which allow for informed agricultural decisions. Boiled down, the more data that can be obtained, the more informed each farmer can be. This relies heavily on broadband.

Based upon the 2017 Census of Agriculture in Clinton County, there are 212,769 acres of farmland, totaling over 747 farms. 80% of these farms have internet access, while the other 20% do not. At minimum, 150 farms do not have any broadband infrastructure to support their operational needs. Some farms have a steep business advantage because of broadband connectivity that aids communication, advertising, ordering, hiring, and utilizing applications that exist online. In addition to a farm operating as a business, the 2017 Census documented that 95% of farms are family farms, which means that the technology available would also be useful for family and personal needs.

Throughout the United States, farms have been using smart farming technology for over 25 years. However, it relies heavily upon broadband to transmit data and efficiently connect farmers with optimal solutions and systems for their farming operations. Broadband infrastructure enables the following technologies for farms: sensors for soil / water / light / humidity / temperature management, software for solutions that target specific farm types, satellite location of equipment or animals, robotics in the form of autonomous tractors and processing facilities, as well as data analytics. The reality of farming today involves managing a fleet of technologically advanced vehicles and equipment, livestock monitoring throughout pastures and facilities of various locations, sharing data sets through cloud storage, farm business planning / accounting, spatial variability within a field while planting, commodity prices and market information, and even monitoring fuel and water tank storage are all factors that rely upon a broadband network. This complex ecosystem of Broadband farming operations by Beecham Research is illustrated below.
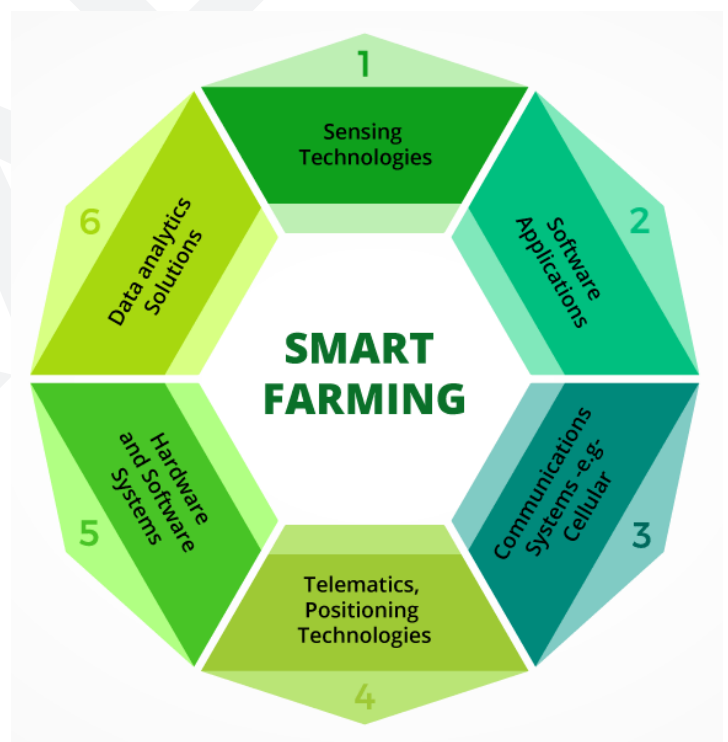
Sciforce. "Smart Farming, or the Future of Agriculture." Medium, Sciforce, 14 Jan. 2019.

THE COVID-19 PANDEMIC AND BROADBAND

MEDICAL CARE: TELE-HEALTH NEED HIGHLIGHTS LACK OF BROADBAND

Rural communities during COVID-19 are struggling for reasons beyond the current virus threat. In order to keep individuals safe while sheltering-in-place, tele-medicine, or tele-health calls, have been significant in keeping patients in touch with their doctors and specialists. Particularly concerning are individuals with pre-existing conditions or coping with a recent diagnosis, needing to frequently communicate or visit their doctor. Broadband is the most viable path available to easily access video calls for tele-health visits, as data caps on cell phones often do not support repeat, long-term video calls. Last year, an average of 8 percent of Americans used tele-medicine. As of June 2020, health care providers reported over 95 percent of visits are virtual. Meanwhile, "21 million Americans lack broadband internet access, especially...in rural areas," according to the Federal Communications Commission.

Many individuals are being given health monitoring devices to help patients with chronic conditions stay home. This is a life line, especially during the pandemic, in which patients, especially with pre-existing conditions, should not be exposed to the virus and should stay at home. Without broadband access, individuals are going without urgent medical appointments and virtual communication with their doctor. The only other option for a virtual health appointment is over the phone. This severely lacks the detail of face to face communication, the capacity to transmit data from wearable devices, and the capacity for one's doctor to observe them at all.

Eighty-four percent of patients currently prefer tele-medicine / tele-health appointments, which clears the way to making it more accessible to the public for several reasons. One of which is that a previous block to telehealth was actually insurance: companies were not covering tele-medicine fees for patients. This has begun to change given the crucial need for distance doctor-patient appointments during the pandemic, as well as the patient's level of preference. Being able to enable and keep tele-health visits for rural folks could help solve other challenges such as transportation to medical visits for older adults.

REMOTE WORK

Among many, one of the largest shifts during COVID-19 is the shift to remote work. As employers take safety precautions to close down office spaces, employees across the country are working from home. Broadband access is crucial for those who already live in rural areas to continue their work successfully while working remotely in their homes. This shift could also present an opportunity for rural areas, as there could be potential migration of people moving from dense urban areas to small rural towns. According to the Center on Rural Innovation, it is possible that remote working could cause innovation and tech careers to disperse from big cities. Broadband access is vital for rural areas to attract and retain this potential population increase for rural communities.

## STUDENTS: DISCONNECTED AT HOME

Because of the COVID-19 pandemic, the educational system in the United States has become dependent upon internet access for teachers and students to communicate. At the start of the pandemic, schools began to plot their educational path forward. Online lesson plans seemed to be an appropriate choice. However, as more and more students face the requirement of internet access, many struggle to continue their education with their teachers.

According to Rural Innovation, "educators and local leaders across the country can't protect rural students from falling significantly behind their connected peers" because of this technological disparity. There are long term repercussions to the current lack of broadband access for students: falling behind peers in school, missing critical learning benchmarks, and isolating these individuals from connecting with their peers and teachers online. There is an urgent need to expand broadband access across the country.
The term frequently used to capture the separation between those with and without broadband access is called the digital divide. The digital divide describes the opportunities in education, employment, and healthcare that have been increasingly moved to online platforms that cannot be accessed without high speed internet. Regarding young students, the gap in internet access limits students without broadband access in their homes. Students are not able to maintain their educational status, and are kept from information because of this disparity. According to the National Center of Education Statistics (NCES), 9 million students lack internet access at home for online learning.

The same disparity applies to households in Clinton County. Local schools lack the capacity to continue teaching because of broadband accessibility gaps. Unfortunately, as shown below in the maps from Rural Innovation, Clinton County schools consist of many students in households who cannot continue their education under the current broadband infrastructure.

BROADBAND ACCESS FOR CLINTON COUNTY SCHOOL DISTRICTS
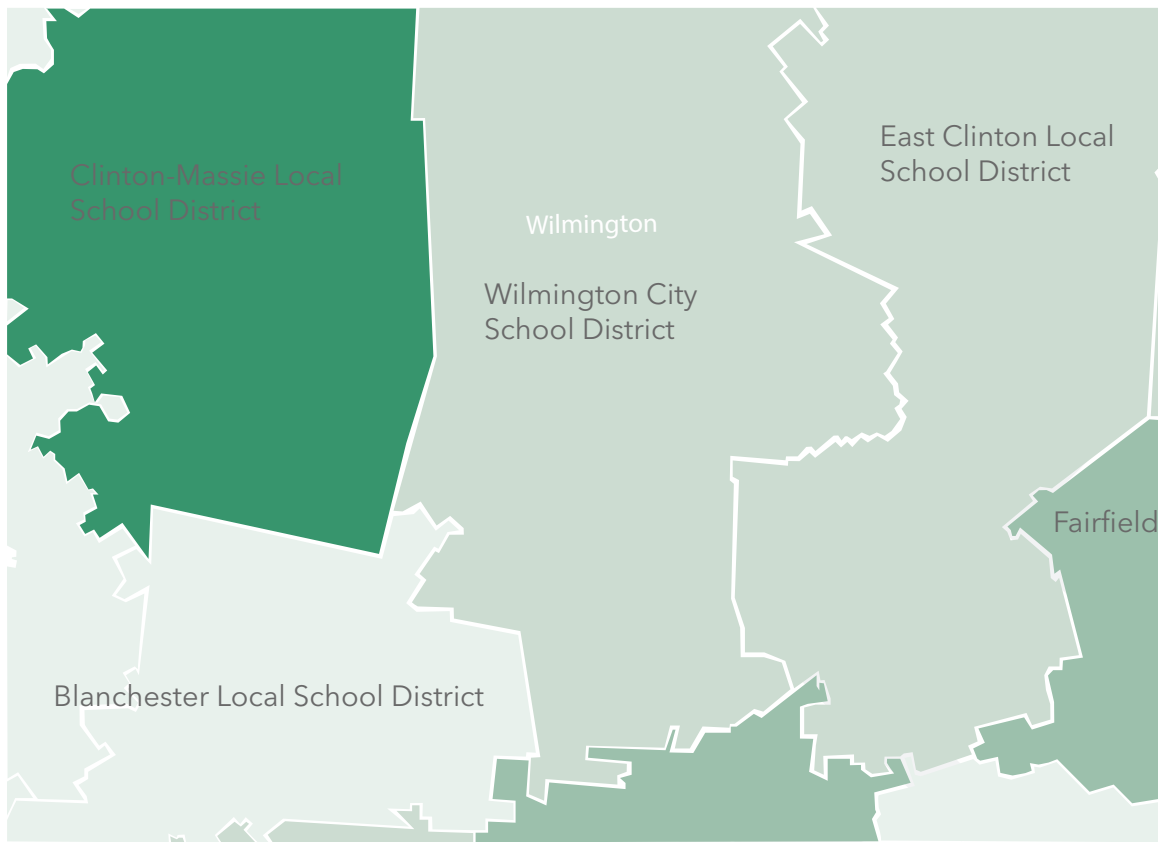
PERCENT LACKING BROADBAND ACCESS

0%   24.4% average   100%

The map (above) illustrates the availability of broadband to school-aged children within Clinton County, at the Clinton Massie, Wilmington, Blanchester and East Clinton school districts. The Broadband Access Map uses data from the FCC to visualize the percentage of students in each school district that lack 25 [download] / 3 [upload] Mpbs broadband access. The map demonstrates the extent of the digital divide, as many of the districts that seem to have service only have access to unreliable DSL or fixed wireless. Below are the school district statistics regarding unserved students.

CLINTON-MASSIE LOCAL SCHOOL DISTRICT
About 74% of students lack at-home broadband access, which is an estimated 1,800 students.

WILMINGTON CITY SCHOOL DISTRICT
About 15% of students lack broadband access at home, an estimated 600 school-aged individuals.

BLANCHESTER LOCAL SCHOOL DISTRICT
About 9.4% of school-aged individuals are without broadband access in this district, which is about 140 individuals.

EAST CLINTON LOCAL SCHOOL DISTRICT
About 19% of school aged individuals are without broadband access, which translates to roughly 350 students.

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CASE STUDY SNAPSHOTS: RURAL SUCCESS IN EXPANDING BROADBAND

Case studies were collected from communities that have expanded their broadband infrastructure successfully. These communities reveal how funding was obtained for their project as well as how they have expanded services to their counties.

OGEMAW COUNTY, MICHIGAN

Ogemaw County in Michigan recently acquired funding to expand rural broadband services throughout the county. Ogemaw County's broadband action plan has identified four priority projects: completing a vertical assets inventory; creating local jobs via teleworking opportunities; hosting website and social media classes for local businesses; and developing a program supporting schools in new technology initiatives, the Public Service Commission noted. The new plan will give the community step-by-step action items to accomplish the objectives.

http://connectmycommunity.org/project-view/building-broadband-above-obstacles-in-rural-michigan/

Ogemaw County partnered with Connect Michigan in order to establish their plan of action, and then began to better understand hurdles facing the county and about how much the county would require financially to install extended service. Several parties have been involved with this such as: the Ogemaw County Economic Development Corporation, Michigan Works! Region 7B Consortium, Ogemaw County Technology Planning Team, and the Northeast Michigan Council of Governments. A grant provided by NEMCOG (The Northeast Michigan Council of Governments) gave the Ogemaw County Economic Development Corporation access to the technology needed to complete the evaluation and the installation.

FILLMORE COUNTY, MINNESOTA

This case study illustrates the fusion of a phone company and a communications cooperative. As of July 2018, Mabel Cooperative Telephone (part of Harmony Telephone Company) and Spring Grove Communications Cooperative established MiBroadband. There are 412 square miles in the county and 40,000 people Harmony Telephone would like to connect through their infrastructure. The collective aims to connect 43 substations that belong to Harmony Telephone with broadband communications. This helps to achieve a "Smart Grid" strategic initiative while also creating a backbone from which to extend broadband service for MiBroadband. Collaborating together provides the region with technical capabilities as well as the resources needed to expand service to rural residences.

https://fillmorecountyjournal.com/broadband-coming-soon-to-rural-rushford/

Using a Reconnect grant from the USDA, the county was able to expand rural broadband to more households. The United States Department of Agriculture invested $11 million in three, high-speed broadband infrastructure projects to improve rural e-Connectivity for more than 1,395 rural households and nearly 120 businesses. MiBroadband is one of many funding recipients in the first round of USDA's ReConnect Pilot Program investments. Harmony Telephone Company will use a $2.7 million ReConnect Program loan and a $2.7 million ReConnect Program grant to construct a fiber-to-the-premises network for 577 households, a health care center and critical community facility. This partnership, coupled with existing staff under both parties to do the installation, expansion, and maintenance of the new infrastructure - helped them win the funding, according to MiEnergy's office.

JEFFERSON & WAYNE COUNTIES, ILLINOIS

Wabash Telephone Co-op was the first Illinois entity to receive a loan-grant combination under the Federal ReConnect Pilot Program. Wabash Telephone Cooperative, founded in 1952, is a member owned group that has strategized a way to provide broadband to their customer base. The Co-op currently operates Wabash Communications which provides broadband, TV services, computer repair and business monitoring systems. A total of $12.8 million dollars in the form of a loan/grant combination will expand broadband to Jefferson and Wayne counties. With advancements of existing and future farming technology, broadband infrastructure will become even more important to the farming community. It costs about $20,000 a mile to put in one mile of fiber at this location and was previously very difficult to facilitate rural broadband installation without the help received from the United States Department of Agriculture. "Wabash Telephone Cooperative, Inc. will use the funding to deploy 298 miles of fiber-optic cable in underserved areas of Jefferson and Wayne counties in Illinois. The investment is anticipated to reach 1,684 households, 31 farms, 29 businesses, nine educational facilities, two critical community facilities and one health care center." In order to receive funding from the USDA, a specific outline had to be provided in the proposal, as well as demonstrated need for broadband. For this particular award, the USDA requires that potential awardees must meet a 25/3 Mbps minimum service requirement in all proposed service areas and the grant is to provide roughly half of the funds for the broadband installation project.

https://www.facebook.com/wabashcommunicationscoop/photos/a.218095404946475/2192430794179583

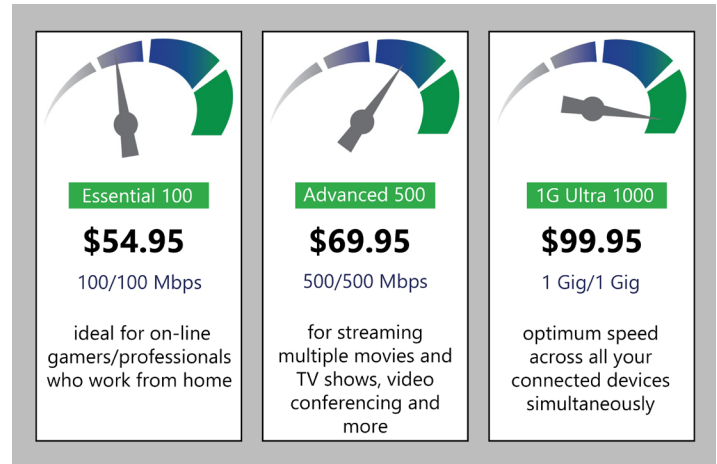## JACKSON COUNTY RURAL ELECTRIC MEMBERSHIP CORP., INDIANA

Jackson County Rural Electric Membership Corp. (REMC) is a member-owned rural electric cooperative located in Brownstown, Indiana. When the Rural Electrification Act of 1936 was enacted, Jackson County REMC was able to provide electricity to rural members with 38 other electric cooperatives in the state of Indiana. For 80 years, Jackson County REMC has been meeting the needs of its members. In 2017, Jackson County REMC created a non-profit division called Jackson Connect dedicated to providing internet. Partnering with other electric cooperatives, contractors, design firms, and county governments, Jackson Connect is able to provide a broadband internet connection up to 1 Gigabit per second (Gbps), which is 1,000 Mbps, to all 20,000 members in the service territory. Jackson Connect utilized the National Rural Telecommunication Cooperative to reform a feasibility study to determine the favorability of offering high-speed internet. It was found favorable and Jackson Connect partnered with county councils in Jackson, Brown, Scott, Lawrence, and Washington about tax abatements in their counties. Additionally, they parted with economic development groups to leverage the project to help economic growth in the counties and townships. In 2019, Governor Eric Holcomb awarded grant money to Jackson County REMC through the Next Level Broadband program. The grant amount titled $1.3 million with a local match of $4 million. The total project cost at $5.2 million will cover 1,050 unserved households, 25 businesses, and eight anchor institutions. At the end of the project, 2,000 miles of fiber will be installed with 2,000 connections.

https://www.jacksonremc.com/

Essential 100	Advanced 500	1G Ultra 1000
$54.95	**$69.95**	**$99.95**
100/100 Mbps	500/500 Mbps	1 Gig/1 Gig
ideal for on-line gamers/professionals who work from home	for streaming multiple movies and TV shows, video conferencing and more	optimum speed across all your connected devices simultaneously

https://www.jacksonremc.com/fiber

GREENLIGHT COMMUNITY BROADBAND, NORTH CAROLINA

In 2004, the City of Wilson, North Carolina conducted feasibility studies on the advantages of building their community-owned fiber network. By 2005, the City of Wilson had connected all their municipal substations with their own fiber network. In 2007 as the City was beginning to construct a fiber-to-the-home network, a local cable provider attempted to block this effort with state legislation. However, the legislation failed and by 2010 broadband services were available to every home and business in the City of Wilson limits as well as the county schools. Eventually, Greenlight was able to lower costs and increase available speeds by connecting to employers and completing the fiber ring. The City caught international attention by being North Carolina's first Gigabit City. Greenlight has a digital inclusion program that offers low-cost internet service to public housing residents and creative pre-pay programs. As of last year, Greenlight hit over 10,000 subscribers and began a 10-week course at a local college called "Fiber Optic Basics." Greenlight's goal in addition to their services is to help other rural communities create innovation-based jobs in the digital economy. Most recently, the City added 30 new public Wi-Fi access points to help with remote learning.

https://www.greenlightnc.com/home-greenlight

https://www.wral.com/greenlight-provides-unique-service-to-city-of-wilson-through-community-broadband/17773039/

THE COOPERATIVE APPROACH TO BROADBAND EXPANSION

Several communities in rural America have navigated cost-prohibitive technology by banding together and establishing community cooperatives. A lack of broadband access has directly impacted the quality of life and the capacity to connect with each other quickly, easily, and more often. Broadband co-ops are changing the lives of residents in their communities simply by partnering with existing electrical infrastructure and obtaining local membership investments. Who could be better situated to care for community members than a locally-focused, locally-grown communications provider?

Wabash is an Ohio-based cooperative that has established broadband service to its members. Starting in the 1980s the co-op installed underground cable service to all subscribers. In 1993, Wabash joined with nineteen other Ohio based independent telephone companies to form a consortium named Com Net. Years later, the company activated a newly installed fiber to the premise network and began offering digital tv to their service area. Today, Wabash has broadband service (with phone and television) available throughout Celina, Coldwater, Fort Recovery, St. Henry, and Rockford.

NRECA (The National Rural Electric Cooperative Association) is a national cooperative that helps communities decide how to proceed with their broadband expansion at a local level. It is the same cooperative that assisted America with establishing electricity as a utility over 80 years ago. Creating a cooperative has benefits that include: readily available technicians in the electrical and telecommunications fields, labor savings through reduced overtime and a small group of new-hires required, harnessing local investments by local residents, and broadband through a cooperative provides more reliable service without a third-party carrier.

While the minimum standard is 25/3 by the FCC, many cooperative members are opting for fiber installation. Selecting to install fiber with 1 Gbps capacity will be beneficial for future-proofing communities. Fiber has the bandwidth to accommodate tele-health video, entertainment, video calls, and fast data upload and download speeds.

According to Brian O'Hara, the Director for NRECA's government relations, this speed increase is crucial right now because some broadband installation companies are still able to install only 10Mbps service with FCC funding from an old agreement, and are leaving homes with coverage not fast enough for reliable service. Investing in a fiber optic cable line is not only supplying members of the cooperative with excellent broadband speed now, but preventing a lapse in service speed for the next several years. Co-ops still

face the financial barrier, just as larger companies face. However, as a local entity there are resources in place already, as well as grants that are for rural broadband expansion specifically for cooperatives. NRECA data shows that about 6.1 million households in or in proximity to electric cooperative service territories are without broadband service.

An intelligent grid will require a consistent communicative network, essentially positioning companies with the benefits of broadband. Local economic benefits are substantial by marketing to members of the cooperative in the area, as well as selling fiber to other enterprises in the area. The larger the cooperative, the greater capacity to scale up with a larger pool of investment.

SAMPLE OUTLINE OF BROADBAND COOPERATIVE PROCESS
1. Feasibility study on electrical and broadband goals
2. Register existing resources
3. Establish purpose for cooperative between parties
4. Conduct membership drive
5. Set legal articles of incorporation
6. Hire cooperative manager
7. Acquire large capital investors
8. Apply for national, state grants for build-out
9. Acquire facility supplies
10. Create plan for sustainable build-out in county
11. Identify broadband type needed in area based upon terrain, goals, funds
12. Begin physical infrastructure changes

RECOMMENDATIONS FOR BROADBAND EXPANSION IN CLINTON COUNTY

Given the need for rural broadband and the funding streams now available, Clinton County requires a plan of action to make broadband access a reality for every household. It is feasible to obtain broadband funding, collaborate with providers, and make this technology readily available throughout the county. It is absolutely essential to provide broadband to residents in the county, and to address steps that will make this service a reality. Clinton County has a responsibility to provide necessary infrastructure to county residents.

1. **IMPROVE LOCAL POLICY: MAKE BROADBAND A UTILITY**
   Broadband as a public utility requires a shift in perspective, but is an avenue to providing a framework for service expansion in the county. Broadband now is comparable to electricity eighty years ago. As Broadband Communities Magazine explains, "utilities are services for the people: a network for economic and domestic living, reaching everyone at a reasonable price." According to this metric, broadband is a utility: it supports businesses, online education, stock market sales, and domestically supports ordering groceries, video calls, entertainment, news, recipes, smart appliances, smart homes, and much more. Just as with other public infrastructure, broadband accessibility should not rely on private providers to choose where access should be available. Establishing broadband as a utility would address this technological divide in Clinton County.

2. **INCLUSION IN THE COMPREHENSIVE PLAN**
   Just as planning and documentation are required for sewer, water, roadways, electricity and telephone - broadband requires a similar approach. The Clinton County Comprehensive plan aims to project how the county will tackle specific projects on behalf of the well-being of the public, and broadband is certainly among the technology required to assist residents with day to day life. A plan of action for the county to expand service should be included in the revised comprehensive county plan in order for broadband to be integrated into the collective vision for the county.

3. **ESTABLISH LOCAL OFFICE FOR BROADBAND INFRASTRUCTURE**
   An Office for Broadband Infrastructure would publicly establish an intent to provide broadband for the county, as well as provide leadership for the county's path forward. Just as other departments in the county require a direct office of transportation or engineering, this office would be a central, physical location for research, funding, and resources. It could create local connections between government officials, broadband providers, and investors. A broadband office would provide a foundation for communication as broadband is installed, as well as a county-wide documentation database. Coordination efforts at the local level could be implemented through an Office for Broadband Infrastructure within Clinton County in order to effectively manage and expand broadband.

3.1 FORM A PARTNERSHIP WITH A LOCAL ELECTRIC / TELEPHONE PROVIDER

In every case study that has had success in expanding broadband, counties have demonstrated collaboration with the existing resources, such as electrical / telephone providers and their existing infrastructure. This is key to the broadband expansion process because companies like DP&L in Clinton County, have resources and technical expertise that can aid in the expansion of broadband. This partnership could also lay the groundwork for co-operative development, and allows for local control over developing broadband infrastructure while maximizing existing local resources and technical experts.

3.2 LOCAL BROADBAND INVESTMENT FUND

There are currently no resources at the county level for broadband funding. Establishing a local fund to pool broadband resources is integral to Clinton County's development and continued connectivity. One of the central hurdles for broadband is the upfront cost companies face installing broadband for rural residences. Cincinnati Bell has roughly estimated that broadband throughout Clinton County will cost $14 million dollars. This number can fluctuate based upon the exact installation method: using existing towers, digging in the ground, sharing substation access, etc. Regardless of the exact broadband technology, Clinton County requires a dedicated fund in order to realize expanded infrastructure. The return on investment is uncertain, therefore companies need partnership funds (from a local investment fund) to make this installation feasible.

3.3 VERTICAL ASSET INVENTORY

Vertical assets include barns, poles, towers, water towers, silos, and other tall structures across the county. With this information, broadband infrastructure costs can be reduced greatly by using existing tall structures in the area. The county needs to map all municipal-owned fiber, conduit, and towers. Then, evaluate any private assets that could be leveraged to support better broadband service to residents. This process is often conducted by a broadband company engineer.

3.4 COMMUNITY BROADBAND BOARD

Clinton County needs the input of rural residents in order to accurately understand and diagnose the county's broadband landscape. Community members need to chair and lead this group. This is a separate arm of the proposed County Broadband Office for the purposes of information gathering and involving the public. The purpose of this board would be to collect statements from rural residents, connect rural property owners with vertical assets, and acquire momentum throughout the county on the issue.

3.5 NEW BROADBAND SERVICE MAP: HOUSE BY HOUSE
Refined data on Clinton County's broadband service is required to specifically plan where in the county to start broadband expansion. There are existing maps that are not showing house-to-house access, but display a census block of broadband service. The county needs to create an unserved (no broadband access) and underserved (low broadband speed but have access) map because the county cannot rely upon the generalizations in the FCC maps. The existing FCC maps are inflated by about 7 to 1, suggesting that broadband is more accessible than it is within Clinton County, because of census block data. A mobile app called TestIT created by the National Association of Counties (NACo) works as a sampling tool to aggregate broadband speeds. Users test internet speeds with the app from anywhere. These snapshots are collected and used to analyze broadband across the country.

4. ESTABLISH COOPERATIVE FOR BROADBAND SERVICE
As a result of the high expenditure associated with broadband infrastructure installed by a corporation, many communities have completed broadband expansion successfully through organizing their own broadband connection (as mentioned in the case study section).

It is logical to approach this infrastructure project from a community level, with members of the cooperative also being members of this community. This would include working with a local power company, collaborating with local specialists, and controlling the broadband expansion from within Clinton County. Benefits of forming a cooperative for broadband include local control over the process, utilizing local investors, and creating partnerships to utilize local utilities and infrastructure. Lastly, the cost can be somewhat controlled and reduced, since there is not a one-time fee for broadband infrastructure build-out by a profit-driven company. There can be controlled measures and planned steps to provide broadband as funds are acquired. Modeled after the electric cooperative that established electricity throughout the United States in 1935, this cooperative would be structured similarly. It should be set up so that the customer / member of the cooperative receives service at-cost broadband, and every customer / member can view costs and expenditures of the co-op. As a cooperative, it would still be able to compete for federal and state funds, as well as have the resources contained within one body to install, maintain and support broadband service.

5. CONDUCT A DEMAND/SERVICE ANALYSIS OF BROADBAND
To get a better understanding of need, Clinton County should conduct an analysis of existing broadband and service and demand within the county.

SOURCES

"About OARnet." Ohio Academic Resources Network. 2 Jan 2020, https://www.oar.net/about.

"About Us." Wabash CO-OP, 2020, wabash.net/about-us/.

"About Us." Greenlight Community Broadband. https://www.greenlightnc.com/about-us/history

"Asset Inventories." Connected Nation, connectednation.org/blog/2018/10/12/asset-inventories/.

Beecham Research, 2014, pp. 1–6, Towards Smart Farming: Agriculture, Embracing the IoT Vision.

"Becoming Broadband Ready." Next Century Cities | Broadband Internet & Infrastructure, 4 Feb. 2020, nextcenturycities.org/becoming-broadband-ready/.

"Broadband Communities." Home, www.bbcmag.com/.

"Broadband Mapping and Analysis." Connected Nation. www.connectednation.org.

"Broadband." United States Department of Agriculture. www.usda.gov/broadband.

"Broadband USA Connecting America's Communities." National Information and Telecommunications Administration. https://www2.ntia.doc.gov/ohio.

Cash, Cathy. "The Beauty of Fiber." Cooperative.com/Remagazine, 30 Apr. 2018, www.cooperative.com/remagazine/articles/Pages/barc-electric-broadband-project.aspx.

Center on Rural Innovation. "Are we witnessing a Great Tech Migration?" Center on Rural Innovation, 1 Sept. 2020, ruralinnovation.us/are-we-witnessing-a-great-tech-migration/

Collinsworth, Rebekah. "How Broadband Inequality Complicates COVID-19 School Closures in Rural Areas." Center on Rural Innovation, 31 Mar. 2020, ruralinnovation.us/covid-19-school-closures-visualizing-broadband-inequality/.

"Community Connect Grants." United States Department of Agriculture. https://www.rd.usda.gov/programs-services/community-connect-grants.

"Connect America Phase II FAQS." Federal Communication Commission, 30 Dec. 2019, https://www.fcc.gov/consumers/guides/connect-america-fund-phase-ii-faqs.

Board, Editorial. "Coronavirus Has Made the Digital Divide More Dangerous than Ever." The Washington Post, WP Company, 29 Mar. 2020, www.washingtonpost.com/opinions/coronavirus-has-made-the-digital-divide-more-dangerous-than-ever/2020/03/29/7ed054e0-706a-11ea-b148-e4ce3fbd85b5_story.html.

"E-Rate Technical Assistance Program." Ohio Department of Education, education.ohio.gov/Topics/Finance-and-Funding/Programs/Educational-Technology/E-Rate-Technical-Assistance-Program.

"Expanding Rural Broadband." USDA. www.effinghamdailynews.com/expanding-rural-broadband-usda-announces-million-loan-grant-for-wabash/article_f56d7b52-16e0-11ea-9e6a-038bf00916e1.html.

FCC Fixed Broadband Deployment, Federal Communications Commission , 2018,broadbandmap.fcc.gov/.

"History of Wabash Mutual." Wabash Mutual Telephone Company, 19 Oct. 2017, wabash.com/about-us/history/.

Hovis, Joanne, and Andrew Afflerbach. "Gigabit Communities: Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community."

Hoffman, Scott. "Tennessee Tried-and-True: Making Broadband Work for Members the Co-Op Way." Tennessee Tried-and-True: Making Broadband Work for Members the Co-Op Way, The National Rural Electric Cooperative Association, 29 May 2019, https://www.electric.coop/tennessee-tried-and-true-making-broadband-work-for-members-the-co-op-way/.

"Jackson County REMC Fiber receives grant for project." The Tribune. November 28,2019. http://www.tribtown.com/2019/11/28/jackson_county_remc_fiber_receives_grant_for_project/

Krambeer, Brian, and Dean Nierling. "Rural Broadband." MiEnergy 2019 Annual Report : Driving Change, Apr. 2020, pp. 1–2.

Lenzer, Jeanne. "The Future of Healthcare Is Here." AARP Bulletin, June 2020, pp. 21–23.

Nelson, Megan. "Rural Americans' Health Depends on Broadband Access." American Farm Bureau Federation - The Voice of Agriculture, 13 Apr. 2020, www.fb.org/market-intel/rural-americans-health-depends-on-broadband-access.

"Ogemaw County Expands Broadband Access." Michigan Technical News. https://mitechnews.com/archive/ogemaw-county-expands-broadband-access/.

"Ohio Broadband Strategies." Innovate Ohio Priorities. www.innovateohio.gov/wps/portal/gov/innovate/priorities/resources/broadband/overview.

"Smart Farming: The Future of Agriculture." IoT For All. 3 Mar. 2020, www.iotforall.com/smart-farming-future-of-agriculture/.

"TestIT: How Fast is Your Broadband." National Association of Counties. https://www.naco.org/resources/testit

"Transit Tech Ohio Overview." Ohio Department of Transportation. www.dot.state.oh.us/Divisions/Planning/Transit/Pages/Tiger-Grant.aspx.

Tucker, Russell, and Ted Solomon. "The Value of a Broadband Backbone for America's Electric Cooperatives." https://www.cooperative.com/Topics/Telecommunications-Broadband/Documents/The Value of a Broadband Backbone.pdf.

"Types of Broadband Connections." Federal Communications Commission. 23 June 2014, https://www.fcc.gov/general/types-broadband-connections

"USDA Census of Agriculture: Clinton County." Clinton County, Ohio, 2017, www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Ohio/cp39027.pdf.

"USDA Invests $11 Million in Broadband." United States Department of Agriculture. January 17, 2020. www.usda.gov/media/press-releases/2020/01/17/usda-invests-11-million-broadband-rural-minnesota-and-Iowa.