Craig County
Craig County - TDS

**Application ID:** 95707212022120200

Application Status: Pending

Program Name: Virginia Telecommunication Initiative 2023 - Application

Organization Name: Craig County

Organization Address:

Profile Manager Name: Dan Collins

**Profile Manager Phone:** 

Profile Manager Email: hokiedc@lumos.net

Project Name: Craig County - TDS

Project Contact Name: Trace Bellassai

Project Contact Phone: (540) 864-5010

Project Contact Email: tbellassai@craigcountyva.gov

Project Location: 108 Court St

New Castle, VA 24127-0000

Project Service Area: Craig County

**Total Requested Amount:** \$4,556,952.00

Required Annual Audit Status: Pending Review

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#### **Budget Information:**

Cost/Activity Category	DHCD Request	Other Funding	Total
Telecommunications	\$4,556,952.00	\$3,037,968.00	\$7,594,920.00
Construction	\$4,556,952.00	\$3,037,968.00	\$7,594,920.00
Total:	\$4,556,952.00	\$3,037,968.00	\$7,594,920.00

#### **Budget Narrative:**

Given the extent of TDS Telecom's operations, it has vast experience in preparing Architectural Designs (ADs) that include detailed cost information for budgeting purposes. TDS Telecom's engineers used the state-provided eligible area map and overlayed TDS Telecom's exchange boundary map and determined which service locations were eligible for deploying a FTTH network under VATI's the grant funding's eligibility rules. Once those eligible service areas were defined, TDS Telecom used these AD's to determine the amount of fiber and equipment needed to provide the eligible locations with GPON technology within the proposed project area. Given TDS Telecom designs FTTH networks regularly, the cost estimates for fiber miles trenched, contractor costs, and negotiated price lists for equipment needed to complete the project are applied to the network design. Using design software, the cost estimates for procuring and constructing the GPON network were then determined. Based upon the costing effort described above, the total construction costs for this project are \$7,594,921. Major expenditures include purchasing electronics such as a Nokia 7360 ISAM FX, or Calix GPON, XGS PON ports and construction/installation. TDS Telecom will own all facilities involved in this project. TDS Telecom does not include the costs for fiber drops in its design nor in its request for grant funding. The costs for the fiber drops will be borne solely by TDS Telecom. All requested funding is for the procurement and installation of equipment and OSP (Outside Plant). Grant funds will not be used for any other purpose except for building the project

#### **Questions and Responses:**

#### 1. Project Description and Need

Describe why and how the project area(s) was selected. Describe the proposed geographic area including specific boundaries of the project area (e.g. street names, local and regional boundaries, etc.). Attach a copy of the map of your project area(s). Label map: Attachment 1 – Project Area Map.

#### Answer:

This project is designed to expand universal broadband coverage for New Castle Telephone Company, d.b.a. TDS Telecom in the Craig County service area. The project area, therefore, are all locations in the County that are currently unserved and are not a part of another VATI (Virginia Telecommunication Initiative) grant application or federally funded initiative. Eligible locations were determined based on the VATI broadband map (Commonwealth Connection) as well as internal mapping data that provides available broadband speeds by service address location, TDS Telecom using its internal network speed testing methodologies (i.e. equipment, service address distance from DSA digital serving areas, along with performance testing) to confirm that speeds at or above 100/20mbps are not available to these locations. See Attachment 1 for the project area map.

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2. List existing providers in the proposed project area and the speeds offered. Describe your outreach efforts to identify existing providers and how this information was compiled with source(s).

#### Answer:

TDS Telecom is the predominant wireline provider in Craig County. Citizens Telephone Cooperative does provide cable service in parts of the County, and any address indicated to be served 100/20 by the VATI broadband map has been removed from our proposed project area. All other carriers in the area do not meet the VATI definition of minimum broadband speed. The VATI broadband map, which reflects all providers in the project area that meet VATI's definition of broadband, was overlayed on to TDS Telecom's broadband mapping information that identifies available broadband speeds by service address.

3. Describe if any areas near the project have received funding from federal grant programs, including but not limited to Connect America Funds II (CAF II), ACAM, ReConnect, Community Connect, and Rural Digital Opportunity Funds (RDOF). If there have been federal funds awarded near the project area(s), provide a map showing these areas, verifying the proposed project area does not conflict with these areas. Label Map: Attachment 2 – Documentation on Federal Funding Area.

#### Answer:

Attachment 2 shows a map of the only Federal grant programs in the Craig County area. The yellow portion of the map reflects a USDA Reconnect area which does not cover the proposed project area. The ACAM plan requires TDS Telecom to build to a specific percentage of locations in the State of Virginia to 25/3mbps while the remaining locations require us to provide at least 10/1 megabytes. All of these ACAM locations (25/3 and 10/1) are included in our project area. There are no RDOF, CAF II or Community Connect funded areas in the proposed project area.

4. Overlap: To be eligible for VATI, applicants must demonstrate that the proposed project area(s) is unserved. An unserved area is defined as an area with speeds below 100/20 Mbps and with less than 25% service overlap within the project area for wireless projects and 20% for wireline projects. Describe any anticipated service overlap with current providers within the project area. Provide a detailed explanation as to how you determined the percentage overlap. Label Attachment: Attachment 3 – Documentation Unserved Area VATI Criteria.

#### Answer:

The proposed project area contains no overlap as identified in Attachment 3. This was confirmed using the VATI Broadband map when overlayed with TDS Telecom's internal mapping by service address, to ensure that no overlapping exists in our proposed project area at eligible speeds.

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- 5. Total Passings: Provide the number of total serviceable units in the project area. Applicants are encouraged to prioritize areas lacking 25 Megabits per second download and 3 Megabits per second upload speeds, as they will receive priority in application scoring. For projects with more than one service area, each service area must have delineated passing information. Label Attachment: Attachment 4 Passings Form.
  - a. Of the total number of VATI passings, provide the number of residential, business, non-residential, and community anchors in the proposed project area.
  - b. If applicable, of the total number of RDOF passings, provide the number of residential, business, non-residential, and community anchors in the proposed project area.
  - c. If applicable, provide the number of passings that will require special construction costs, defined as a one-time fee above normal service connection fees required to provide broadband access to a premise. Describe the methodology used for these projections.
  - d. If applicable, provide the number of passings included in the application that will receive broadband access because special construction costs have been budgeted in the VATI application. Describe the methodology used for determining which passings with special construction costs were budgeted in the application.
  - e. Provide the number of passings in the project area that have 25/3 Mbps or less. Describe the methodology used for these projections. (up to 15 points)

#### Answer:

A. There are 2,885 total serviceable locations which are currently unserved and underserved as per the definition of VATI. See Attachment 4 and these are all captured in our proposed project area

B. N/A

C. N/A

D. N/A

- E. There are 1,249 locations passed that are served at broadband speeds of less than 25/3mbps by any carrier. TDS Telecom produces a map that identifies broadband speed at each service address. This data is confirmed by using internal network speed testing methodologies (i.e. equipment, service address distance from DSA digital serving areas, along with performance testing) to ensure the 25/3mbps or less address location counts are accurate.
- 6. Describe if any blocks awarded in Rural Digital Opportunity Fund (RDOF) are included in the VATI application area. If RDOF areas are included in the VATI application, provide a map of these areas and include information on number of passings in RDOF awarded areas within the VATI application area, and Census Block Group ID number for each block group in the project area. Label Attachment: Attachment 5 RDOF Awarded Areas Form in VATI Area

#### Answer:

There are no RDOF areas in our proposed project area as the entire project area was precluded from any provider receiving RDOF funding due to RDOF requirements and parameters.

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7. **For wireless projects only:** Please explain the ownership of the proposed wireless infrastructure. Please describe if the private co-applicant will own or lease the radio mast, tower, or other vertical structure onto which the wireless infrastructure will be installed.

#### Answer:

N/A

8. Network Design: Provide a description of the network system design used to deliver broadband service from the network's primary internet point(s) of presence to end users, including the network components that already exist and the ones that would be added by the proposed project. Provide a detailed explanation of how this information was determined with sources. Provide information on how capacity for scalability, or expansion, of how the network can adapt to future needs. If using a technology with shared bandwidth, describe how the equipment will handle capacity during peak intervals. For wireless projects, provide a propagation map for the proposed project area with a clearly defined legend for scale of map. Label Map: Attachment 6 – Propagation Map Wireless Project.

#### Answer:

TDS Telecom will deploy a FTTH (Fiber to the Home) network using Gigabit Passive Optical Network (GPON) technology. GPON can deliver 2Gbps symmetrical broadband speeds to all customers that have access to the fiber. Given that fiber is in general maintenance free, the FTTH network will provide the company with a platform to scale ("scalability") as successive generations of optical technology become available and meet the consumer's ever-increasing demands for bandwidth. Traffic will be aggregated in the company's central office on an IP (Internet Protocol) router where it will be transported to the company's IP core network through leased backhaul facilities. The company manages its network to the capacity needs of its subscribers and does not use pre-determined over subscription or per subscriber bandwidth usage assumptions for maintaining its networks. Consequently, backhaul and core Internet links are managed in terms of capacity, trended usage growth, and equipment/link status. See response to question#2 above for more detailed discussion. Attachment 6 does not pertain to this grant request.

9. Speeds: Describe the internet service offerings, including download and upload speeds, to be provided after completion of the proposed project. Detail whether that speed is based on dedicated or shared bandwidth, and detail the technology that will be used. This description can be illustrated by a map or schematic diagram, as appropriate. List the private co-applicant's tiered price structure for all speed offerings in the proposed project area, including the lowest tiered speed offering at or above 100/20 Mbps. (up to 10 points)

#### Answer:

Standard broadband data speeds offered to consumers and businesses will be symmetrical: 300Mbps download/300 Mbps upload; 600Mbps download/600 Mbps upload and: 1 Gbps (1,000 Mbps) download and 1 Gbps (1,000 Mbps) upload, 2Gbps (2,000Mbps) upload and 2 Gbps (2,000mbps) download and upload. There are no data caps for customers within the proposed project area. All broadband plans include the ability to subscribe to Wi-Fi access. Equipment to provide Wi-Fi is an additional \$10 per month for the TDS Telecom Wi-Fi product, or customers can utilize their own router for no additional charge. The rates below are for residential customers at the submission of this grant application. All speeds, rates and terms of services listed herein are subject to change.

The current pricing of our broadband products is the following:

**Service Tier** 

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Max Download/Upload

Price per Month (2yr Promo/ Regular)

2 Gig-Fiber Internet

2Gbps/2Gbps

\$299.00 non-promotional

1Gig Fiber Internet

1Gbps/1Gbps

\$89.95/\$114.95

Extreme 600 Fiber Internet

600Mbps/600Mbps

\$69.95/\$94.95

Extreme 300 Fiber Internet

300Mbps/300Mbps

\$49.95/\$74.95

Note:

(1) TDS Telecom also offers these products at rates for bundled services

(2) Promotional pricing varies and may not be available in all areas.

(3) Lower speed options are available, but rates are similar to the 300Mbps offering

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TDS Telecom currently participates in the ACAM testing methodology for testing speed and latency of our broadband offerings. As such, TDS Telecom follows all prescribed rules and requirements laid out in FCC (Federal Communications Commission) Order DA-18-710 for ACAM recipients. The testing is conducted between the "Whitebox," which is a software application loaded into a customer's modem in the customer premises coupled with a testing platform that is located remotely to our service area. Testing involves multiple testing of speed and latency during peak usage times where packets of IP data are passed, and timeframes are measured. With the known data regarding packet size and length of time to pass the packets, performance of the network can be measured. A\_latency test is a single measurement of latency, often performed using a single User Datagram Protocol (UDP) packet or a group of three Internet Control Message Protocol (ICMP) or UDP packets sent at the same time. The duration of time between when the packet is sent and when there is a response measures latency. The above-described methodology will be utilized in the event of a testing request in the future. Not every customer's modem is loaded with the Whitebox

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software, and any speed test request may require pre-work to assure testing availability.

10. Explain how the proposed project achieves universal broadband coverage for the locality or fits into a larger plan to achieve universal broadband coverage for the locality. If applicable, explain the remaining areas of need in the locality and a brief description of the plan to achieve universal broadband coverage. (up to 50 points)

#### Answer:

Currently TDS and PemTel together cover the entire county with DSL. By partnering with TDS in their existing DSL coverage area (excluding areas always served by 100/20 mbps service), and PemTel in their existing coverage area, this will provide for universal, county-wide broadband speeds of 100/20 or greater. Craig County will be submitting a separate application with PemTel, and the two projects together will provide for universal coverage.

This project achieves universal broadband coverage for the citizens of Craig County located in TDS Telecom's service area, by deploying a FTTH network using Gigabit Passive Optical Network (GPON) technology to every location except for where the minimum broadband speeds (100/20) are already provided as defined by the VATI rules (100/20). There are no federal grants that have been awarded within our proposed service project area. To reiterate, every eligible service location with TDS Telecom serving area in Craig County will be served by fiber within the VATI 18-month time frame as described in our build timeline (See Attachment 7).

#### 11. Project Readiness

Describe the current state of project development, including but not limited to: planning, preliminary engineering, identifying easements/permits, status of MOU or MOA, and final design. Prepare a detailed project timeline or construction schedule, identifying specific tasks, staff, contractor(s) responsible, collection of data, etc., and estimated start and completion dates. Applicants are encouraged to extensively discuss, where applicable, easements relating to railroad crossings, federally-owned lands and parks, partnerships with the Virginia Department of Transportation, and mobile home parks. Applicants must include Memorandums of Understanding (MOUs)or Memorandums of Agreement (MOAs) between applicants (drafts are allowable). Label Attachments: Attachment 7 – Timeline/Project Management Plan; Attachment 8 – MOU/MOA between Applicant/Co-Applicant; (up to 10 points)

#### Answer:

Per the VATI broadband grant rules, the proposed project completion timeline will meet the 18-month grant requirement once the execution of the awarded grant is complete between Craig County, TDS Telecom and DHCD. The company intends to be in full compliance with the VATI buildout timeframe (see Attachment 7).

TDS Telecom prepares an AD (Architectural Design) that determines the amount of fiber and equipment needed (Digital Service equipment Nokia 7360) to provide the eligible locations with GPON technology. Given TDS Telecom designs FTTH networks daily, the cost estimates for fiber miles trenched, contractor costs, and negotiated price lists for equipment needed are applied to the network design. Using design software, the cost estimates for procuring and constructing the GPON network are then determined.

TDS Telecom's proposed project timeline is compiled based on standard engineering, implementation, construction, permitting, cutover, and testing certification intervals. The company has done its best to incorporate risk into the proposed timeline. TDS Telecom will provide best efforts to complete the proposed project within the required 18-month timeline. However, due to the geographic location(s) of construction including lands held in private ownership, possible supply chain delays, typical municipal, state, federal, private, and agency requirements as well as potential Acts of God, deviation from the timeline might be experienced which is beyond the company's control. Should this occur, timely communication would be provided to DHCD by TDS Telecom regarding any delays and construction of the status of construction of the project.

12. Has the applicant or co-applicant received any VATI grants? If so, provide a list of these grants, with a detailed summary of the status of each.

#### Answer:

Neither TDS nor Craig County has received previous VATI awards.

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See Attachments 9, 10,11.

13. Matching funds: Complete the funding sources table indicating the cash match and inkind resources from the applicant, co-applicant, and any other partners investing in the proposed project (VATI funding cannot exceed 80 percent of total project cost). In-kind resources include, but are not limited to: grant management, acquisition of rights of way or easements, waiving permit fees, force account labor, etc. Please note that a minimum20% match is required to be eligible for VATI, the private sector provider must provide10% of the required match. If the private co-applicant cash match is below 10% of total project cost, applicants must provide financial details demonstrating appropriate private investment. If applicants and co-applicants are seeking to include prior expended funds as matching funds, Attachment 11 must be completed. Label Attachments: Attachment 9 - Funding Sources Table; Attachment 10 – Documentation of Match Funding; Attachment 11 - Prior Expended Match Form

## Answer: Source **Amount** % **Status** Requested VATI \$4,556,952 60 Pending Private (TDS) \$3,037,969 40 Confirmed Total \$7,594,921 100 Confirmed

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14. Leverage: Describe any leverage being provided by the applicant, co-applicant, and partner(s) in support of the proposed project. (up to 10 points)

#### Answer:

The proposed project will leverage the Applicant's financial, managerial, and operational experience as well as our existing network and back-office systems. TDS Telecom has vast experience deploying, upgrading, and managing broadband networks in 32 states.

All of these create efficiencies which lead to reductions in construction and operational costs. Specifically, TDS Telecom already has facilities within the proposed project footprint where it will deploy fiber and GPON equipment to provide broadband services at (and in excess of the required speeds). The proposed project is an enhancement/extension of our existing network. The expense of operating and maintaining (O&M) the proposed network will be less than a copper network given the technology that will be deployed.

The incremental revenues generated from building this network will be used to leverage and aid in supporting the O&M of the network. TDS Telecom also expects the customer adoption rate for these new services to be similar to what TDS Telecom has experienced in other areas of the Country where TDS Telecom has deployed GPON.

TDS Telecom has worked closely with the Craig County Broadband Committee to develop this proposed project and pursue this partnership opportunity jointly. The Committee has identified the County's broadband needs, communicated the fiber to the home project with residents and businesses and assisted TDS Telecom in obtaining community support for this critical project for Craig County (See Attachment 14).

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- 15. Communications Plan: Describe efforts to keep the public informed of project progress and the broadband adoption plan.
  - a. Explain how you plan on communicating the project status to stakeholders, including but not limited to County leadership, project areas residents, etc. (Up to 10 points)
  - b. Explain how you plan to promote customer take rate, including marketing activities, outreach plan, and other actions to reach the identified serviceable units within the project area. Provide the anticipated take rate and describe the basis for the estimate. (up to 10 points)
  - c. Describe any digital literacy efforts to ensure residents and businesses in the proposed project area sufficiently utilize broadband. Please list any partnering organizations for digital literacy, such as the local library or cooperative extension office.

#### Answer:

TDS Telecom will provide a status update quarterly (via conference calls and electronic reports) with the Craig County Broadband Committee to inform them of the build progress which they will then share with the public via its Facebook page, county website, and working with the local newspaper.

In addition, when TDS deploys broadband in an area, it communicates with residents regarding our new product offerings, price, and speed of the new services offered to ensure customers are aware that they are now available. This is done via door-to-door sales, emails, bill inserts, along with our field service technicians having discussions with customers during in person interactions.

TDS Telecom will also announce the offering of the service in the local media through a targeted communication release. As experienced in other markets, once the company has marketed the new broadband services to our customers, TDS Telecom has seen the adoption rates in these rural areas to be similar to those in more densely populated areas, i.e., users begin to understand the advantages of high-speed broadband and the impact it can have on their lives, whether it be working from home, online educational courses, shopping, etc. TDS Telecom's experience with fiber broadband speed offerings is that consumers will subscribe to these new higher speed offerings at a penetration rate of at least 60% by year 4.

16. Project Management: Identify key individuals who will be responsible for the management of the project and provide a brief description of their role and responsibilities for the project. Present this information in table format. Provide a brief description of the applicant and co applicant's history and experience with managing grants and constructing broadband communication facilities.

#### Answer:

As a subsidiary of TDS, Inc., TDS Telecom (of which the applicant is a subsidiary) will be responsible for building and managing all aspects of the proposed project. TDS Telecom's Senior Management team is fully capable of building, operating, and maintaining the network infrastructure proposed within this application, as this is a natural extension of its existing service history. TDS Telecom has a solid performance record in delivering advanced communications solutions to a wide and diverse customer base in rural areas across the country, operating 105 subsidiaries that are incumbent local, exclusively rural local exchange carriers (ILEC) that serve primarily rural area and currently serve 1.2 million commercial and residential connections in twenty-five (25) states. For the past decade, the senior TDS Telecom Management team has worked together to build multiple broadband networks that meet and exceed the size, scope, and complexity of the proposed project area.

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TDS Telecom has been awarded 22 individual state grants which resulting in receiving almost \$35M in grant funding to build to over 24,000 locations. TDS Telecom has also been awarded Federal 44 grants total of \$105M in grant funding serving over 27,000 locations.

Craig county has a history of managing numerous grants including emergency services and ARPA funded grants.

The total cost of the project is \$7,594,921 of which TDS Telecom will be contributing \$3,037,968 of our own capital. See Attachment 12.

Name	
Title	
Role	
Jim Butman	

Chief Executive Officer

Ensuring the company delivers high quality products and services to customers throughout the country. Creation of a transparent, diverse, and rewarding work environment for all employees while delivering shareholders a strong return on their investment.

Mark Barber

**Chief Operating Officer** 

Responsible for all day-to-day operations—Field Services, Network Assurance, Facilities, Call Center Operations, Consumer and Commercial Sales, Product Development and Marketing.

Michelle Brukwicki

Chief Financial Officer

Responsible for strategic and long-range planning, financial analysis, accounting, internal controls, billing, revenue assurance, and supply chain services.

Ken Paker

**Chief Technical Officer** 

Responsibilities include technical direction of the company's network and IT evolution. He oversees the delivery of software and infrastructure projects across diverse, state-of-the-art network technologies, as well as the company's mission-critical IT applications and services. Direct the planning, engineering, and building of TDS Telecom's networks to ensure customers have access to the most reliable internet, phone, and TV services.

Julie Maiers

Senior Vice President Marketing, Sales, and Customer Operations

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Lead the marketing, product and sales strategies for the company's telecom, cable, and fiber expansion sectors. Oversight of the company's customer operations, including the sales and repair contact centers.

Andrew (Drew) Petersen

Senior Vice President of Corporate Affairs

Lead the company's out of territory community expansion efforts. Oversee the company's regulatory, legislative, and judicial efforts at the local, state, and national levels. Advance TDS Telecom's public policy positions, through partnerships with industry-affiliated trade organizations and federal and state policymakers. Supervises the business development, compliance, and legal affairs groups. Manages internal and external communications at TDS Telecom, serves as the company's chief corporate spokesperson and oversees Zolo Media, a TDS Broadcasting company that operates KOHD-TV, KBNZ, COTV11, and CO4 Visitors Network, which offers a wide range of viewing options in Central Oregon.

**Shane West** 

Senior Vice President of Network Operations

oversight of the field services and repair teams responsible for all service installations, resolutions, preventative maintenance, and outage restoration efforts for the company's telecom and cable operations.

Benjamin (Ben) C. Goth

Vice President of Network Services

Oversight of the planning, engineering, and implementation for TDS Telecom's network build projects. This includes leading the teams responsible for executing more than a dozen out-of-territory fiber overbuilds and managing TDS Telecom's ACAM project build-outs—the company's largest capital initiative and revenue generating project.

**Andrew Buchert** 

Vice President of Field Services

Responsibility for the entire Field Services team—the largest employee group at TDS Telecom. Under his guidance, this team provides timely service installations for consumer and commercial customers, across the company's entire footprint. They also perform routine preventative maintenance, including testing the integrity of the inside and outside plant networks to ensure ongoing availability of internet, video, and voice services. In addition, this team is responsible for repairing any service-related outages regardless of the cause.

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#### 17. Project Budget and Cost Appropriateness

Budget: Applicants must provide a detailed budget that outlines how the grant funds will be utilized, including an itemization of equipment, construction costs, and a justification of proposed expenses. If designating more than one service area in a single application, each service area must have delineated budget information. For wireless projects, please include delineated budget information by each tower. Expenses should be substantiated by clear cost estimates. Include copies of vendor quotes or documented cost estimates supporting the proposed budget. Label Attachments: Attachment 12 – Derivation of Costs; Attachment 13 - Documentation of Supporting Cost Estimates. (up to 10 points)

#### Answer:

Given the extent of TDS Telecom's operations, it has vast experience in preparing Architectural Designs (ADs) that include detailed cost information for budgeting purposes. TDS Telecom's engineers used the state-provided eligible area map and overlayed TDS Telecom's exchange boundary map and determined which service locations were eligible for deploying a FTTH network under VATI's the grant funding's eligibility rules.

Once those eligible service areas were defined, TDS Telecom used these AD's to determine the amount of fiber and equipment needed to provide the eligible locations with GPON technology within the proposed project area. Given TDS Telecom designs FTTH networks regularly, the cost estimates for fiber miles trenched, contractor costs, and negotiated price lists for equipment needed to complete the project are applied to the network design. Using design software, the cost estimates for procuring and constructing the GPON network were then determined. Based upon the costing effort described above, the total construction costs for this project are \$7,594,921. Major expenditures include purchasing electronics such as a Nokia 7360 ISAM FX, or Calix GPON, XGS PON ports and construction/installation. TDS Telecom will own all facilities involved in this project. TDS Telecom does not include the costs for fiber drops in its design nor in its request for grant funding. The costs for the fiber drops will be borne solely by TDS Telecom. All requested funding is for the procurement and installation of equipment and OSP (Outside Plant). Grant funds will not be used for any other purpose except for building the project (See Attachment 12, 13).

- 18. The cost benefit index is comprised of state cost per unit passed. Individual cost benefit scores are calculated and averaged together to create a point scale for a composite score. Provide the following:
  - a. Total VATI funding request
  - b. Number of serviceable units (up to 125 points)

#### Answer:

- a. Total VATI funding request--\$4,556,952
- b. Number of serviceable units--2,885

19.

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#### Commonwealth Priorities (Up to 50 points)

Additional points will be awarded to proposed projects that reflect Commonwealth priorities. If applicable, describe the following:

- a. Businesses, community anchors, or other passings in the proposed project area that will have a significant impact on the locality or region because of access to broadband.
- b. Unique partnerships involved in the proposed project. Examples include electric utilities, universities, and federal/state agencies.
- c. Digital equity efforts to ensure low to moderate income households in the proposed project area will have affordable access to speeds at or above 100/20 mbps, include information regarding the internet service provider's participation in the Affordable Connectivity Program
- d. The co-applicant's efforts to mitigate supply chain constraints, including labor shortages and order-to-delivery delays on telecommunications materials required to construct broadband networks.
- e. The applicant's and co-applicant's efforts to promote broadband adoption, including, but not limited to: telehealth, smart farming, e-entrepreneurship, and distance learning.

#### Answer:

- A. TDS Telecom has identified 12 Community Anchors that are currently underserved per VATI broadband definitions by any carrier in the proposed project area. After the completion of this project all 12 community anchor institutions will have access to FTTH and up to 2 Gbps symmetrical broadband speeds
- B. This VATI grant application reflects a partnership between Craig County and TDS Telecom.
- c. TDS Telecom fully supports offering affordable broadband products to those in need. To address affordability for customers that need assistance with broadband, TDS Telecom will offer its TDS Connect product to those located within the proposed service area to aid qualified customers that need internet but may not be able to afford it. TDS Connect specifically provides qualified customers with up to 25/5Mbps internet access for \$19.95/month for the first 12-months, including free Wi-Fi. After 12 months, the cost is currently \$29.95/month. Also, TDS Telecom participates in the Affordability Connectivity Program (which replaced the Emergency Broadband Benefit program) providing a discount for broadband services for eligible customers as funded by the Infrastructure Investment and Jobs Act of 2021, which would be available to all qualified customers in the proposed project area. TDS Telecom also participates in the Department of Housing and Community Development (DHCD) program Line Extension Customer Assistance Program (LECAP). The program reduces the barrier for broadband access for low to moderate income households in Virginia's by reducing the customers cost of connection.
- D. To the best of our ability, TDS Telecom has taken proactive measures to try and mitigate risk and address the market realities of supply chain constraints, including labor shortages and order-to-delivery delays for telecommunications materials required to construct broadband networks.

These measures include, but are not limited to the following:

 Developed a list of critical supply materials, equipment and vehicles needed to ensure ability to deploy services

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- Advanced the ordering and purchase of materials, equipment, and vehicles based on forecasted needs and estimated lead times into 2023 and 2024
- · Purchasing safety stock for critical materials to address any potential gaps or shortfalls
- Providing up front funding with advance payment of estimated contract value to select contractors for the purchase of materials in advance when appropriate
- Addressing requests for increased costs from contractors due to materials, fuel, and labor cost increases that are validated and targeted to meet real markets conditions and not just broadbased requests
- Negotiating all new contracts that account for and allow pricing/cost flexibility moving forward based on agreed upon parameters when necessary
- Investing in TDS Telecom self-perform construction crews for targeted markets as a solution to fill potential gaps in labor or equipment availability

E. TDS Telecom will actively ensure consumer awareness of the availability of our fiber broadband products which will improve residents and businesses understanding of the benefits of super high-speed internet.

When TDS Telecom deploys broadband in an area, it communicates with residents regarding our new product offerings, pricing, and speed of the new services offered to ensure customers are aware that they are now available. This is done via door-to-door sales, emails, bill inserts, along with our field service technicians having discussions with customers during in person interactions.

TDS Telecom will also announce the offering of the new broadband services in the local media through a targeted communication release.

In addition, the Craig County Broadband Committee will inform residents of the build progress and high-speed broadband services offered via its Facebook page and website.

The Craig County Broadband Committee has also gained support for this project from the local School system, who have many concerns with the lack of broadband availability in the area. The requirement for not only distance learning, but even the ability to complete assigned homework will also help drive adoption.

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Craig County

Craig County - TDS

#### 20. Additional Information

Please attach any letters of support from stakeholders. If the applicant is not a locality(s) in which the project will occur, please provide a letter of support from that locality.

Attachment 14 – Letters of Support.

Provide the two most recent Form 477 submitted to the FCC, or equivalent, as well as point, polygon, and, for wireless providers, RSSI shapefiles for the project area **in .zip file form**. With attachments 17 through 20, attach any other information that the applicant desires to include. Applicants are limited to four additional attachments.

Label Additional Attachments as:

- a. Attachment 15 –Two most recent Form 477 submitted to the FCC or equivalent
- b. Attachment 16 Point and Polygon shapefiles, in.zip file form, showing proposed passings and project area
- c. Attachment 17 For wireless applicants: shapefiles, in .zip file form, indicating RSSI projections in the application area
- d. Attachment 18 XXXXXXX
- e. Attachment 19 XXXXXXX
- f. Attachment 20 XXXXXXX

#### Answer:

In Attachment 14, please see the list of major stakeholders, including Senator Newman, Senator Warner, Congressman Griffith, Councilman Macdonald, and heads of the departments of Health, Social Services, Economic Development Authority, Craig County Public Schools, and Emergency Services that are supporting this grant application. There are also letters of support from Delegate Austin, Delegate McNamara, and Delegate Head.

The Broadband Study conducted by the Craig County Broadband Committee is also attached in optional Attachment 18, which has survey data from residents and businesses and analysis of the current state of Broadband in the county, among other details.

#### **Attachments:**

Map(s) of project area, including proposed infrastructure

Attachment1ProjectCoverage825202243210.pdf

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Craig County
Craig County - TDS

Documentation of Federal Funding (CAF/ACAM/USDA/RDOF, etc...) in and/or near proposed project area.

Attachment2ReconnectServiceAreaCraigCountyVA8252022111246.pdf

Documentation that proposed project area is unserved based on VATI criteria

Attachment3TDSBBGrantCraigCountyMap8252022111253.pdf

Passings Form (Use template provided)

Attachment4VATIPassingsForm612022826408252022111711.pdf

Documentation of RDOF awarded area in VATI project Area (Use template provided)

Attachment 5 RDOFA warded Passings In VATIA pplication Area 612022828198252022111714. pdf and the contraction of the contract

Timeline/Project Management Plan

Attachment7CraigCountyTimeline8252022111727.pdf

Funding Sources Table (Use template provided)

Attachment9FundingSources8252022111922.pdf

Documentation of Match Funding

Attachment10DocumentationofMatchFunding825202231029.pdf

Derivation of Cost/Project Budget (Use template provided)

Attachment12DerivationofCostsWorksheet11162016228387242017448188252022112332.pdf

**Documentation of Supporting Cost Estimates** 

Attachment13Documentationsupportingprojectcosts8252022112338.pdf

Letters of Support

Attachment14LettersofSupport8252022112555.pdf

Two most recent Form 477 submitted to the FCC or equivalent

Attachment15FCC4778252022112446.pdf

8/26/2022 10:43:13 AM Pages: 17 of 18

**Craig County** 

Craig County - TDS

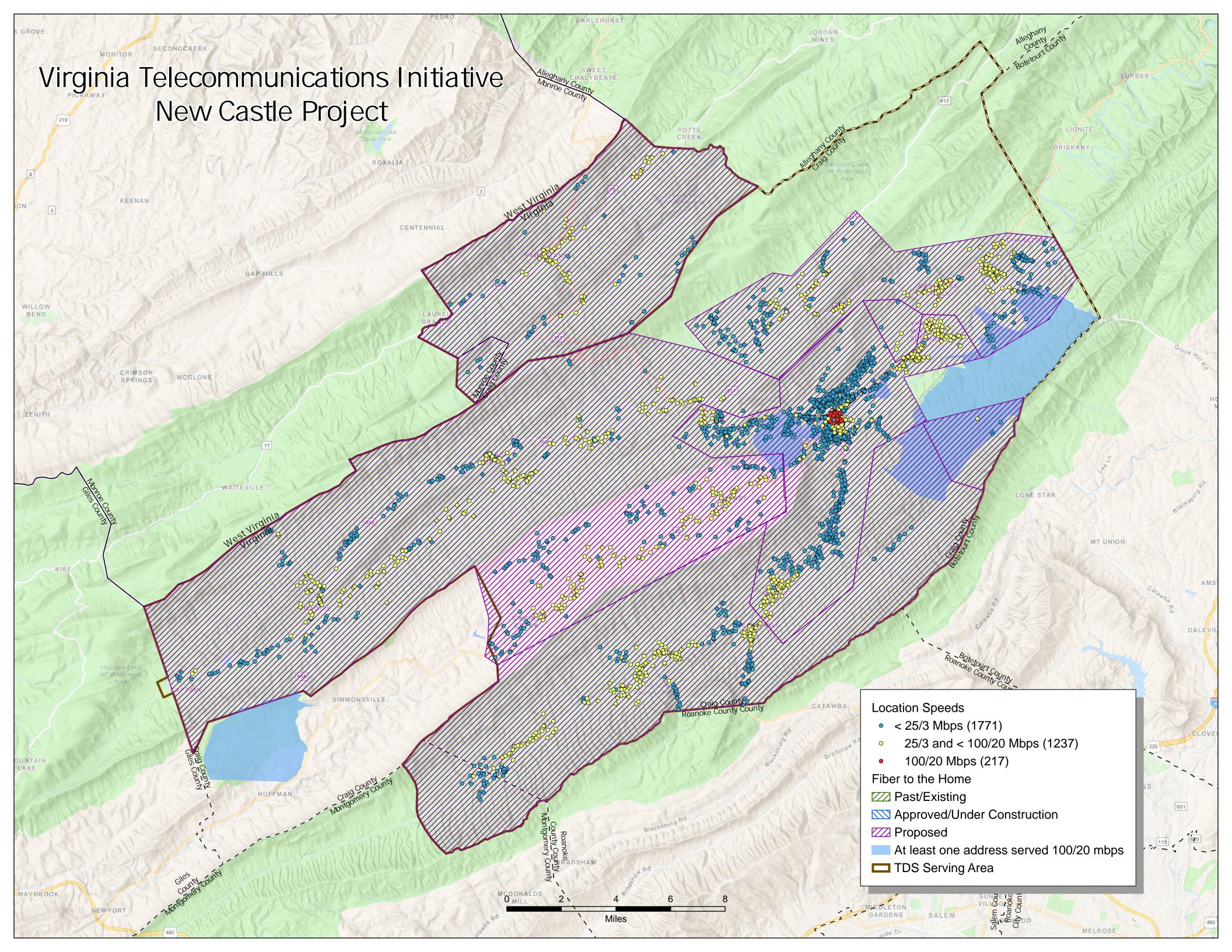
Point and Polygon shapefiles, in.zip file form, showing proposed passings and project area

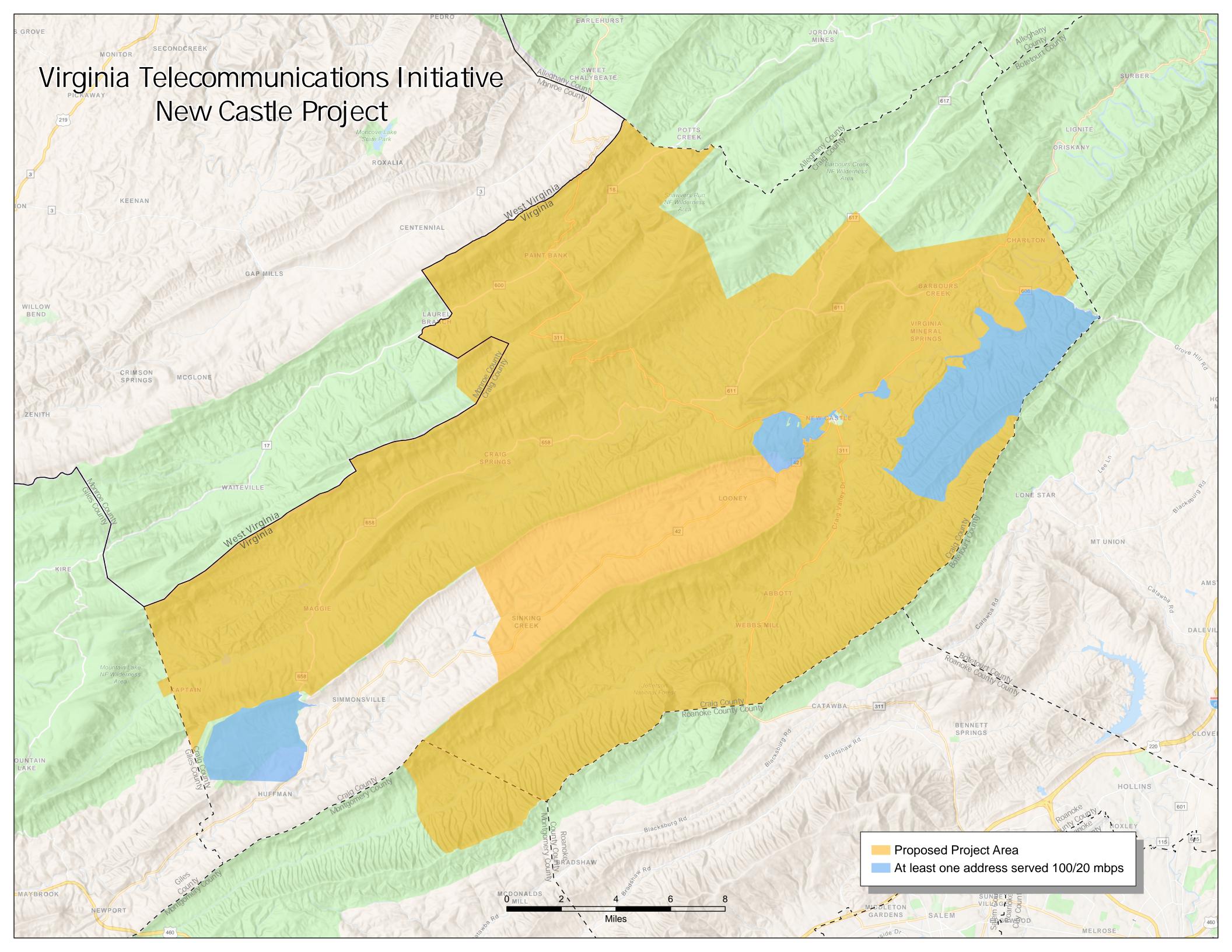
Attachment16TDSCraigCountyBBGrant8252022112604.zip

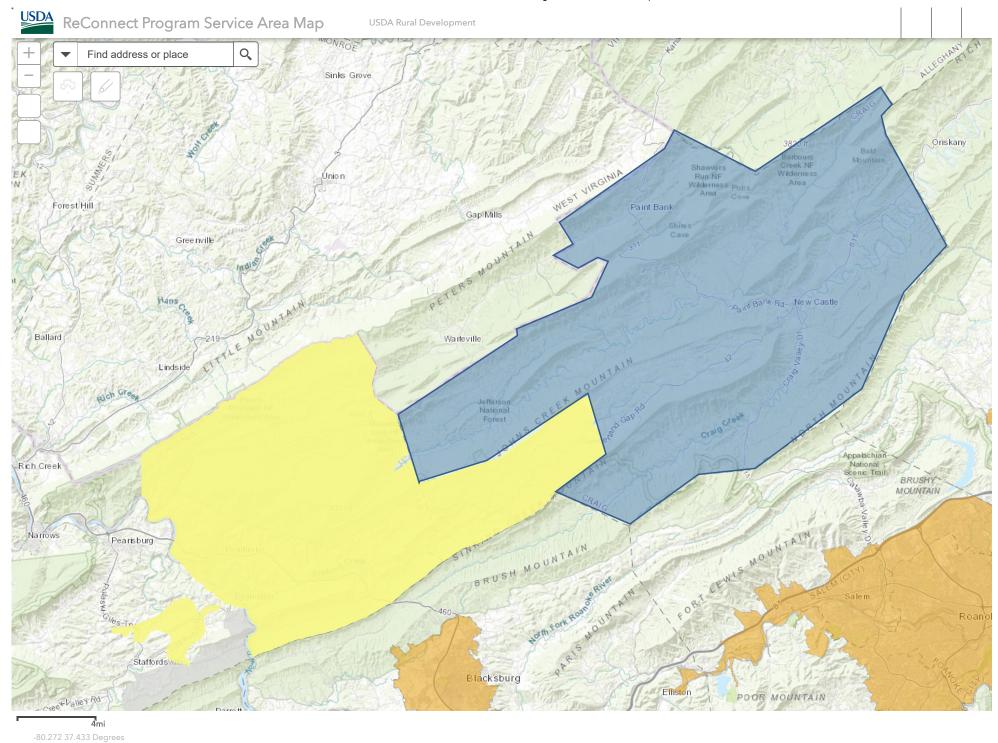
Optional

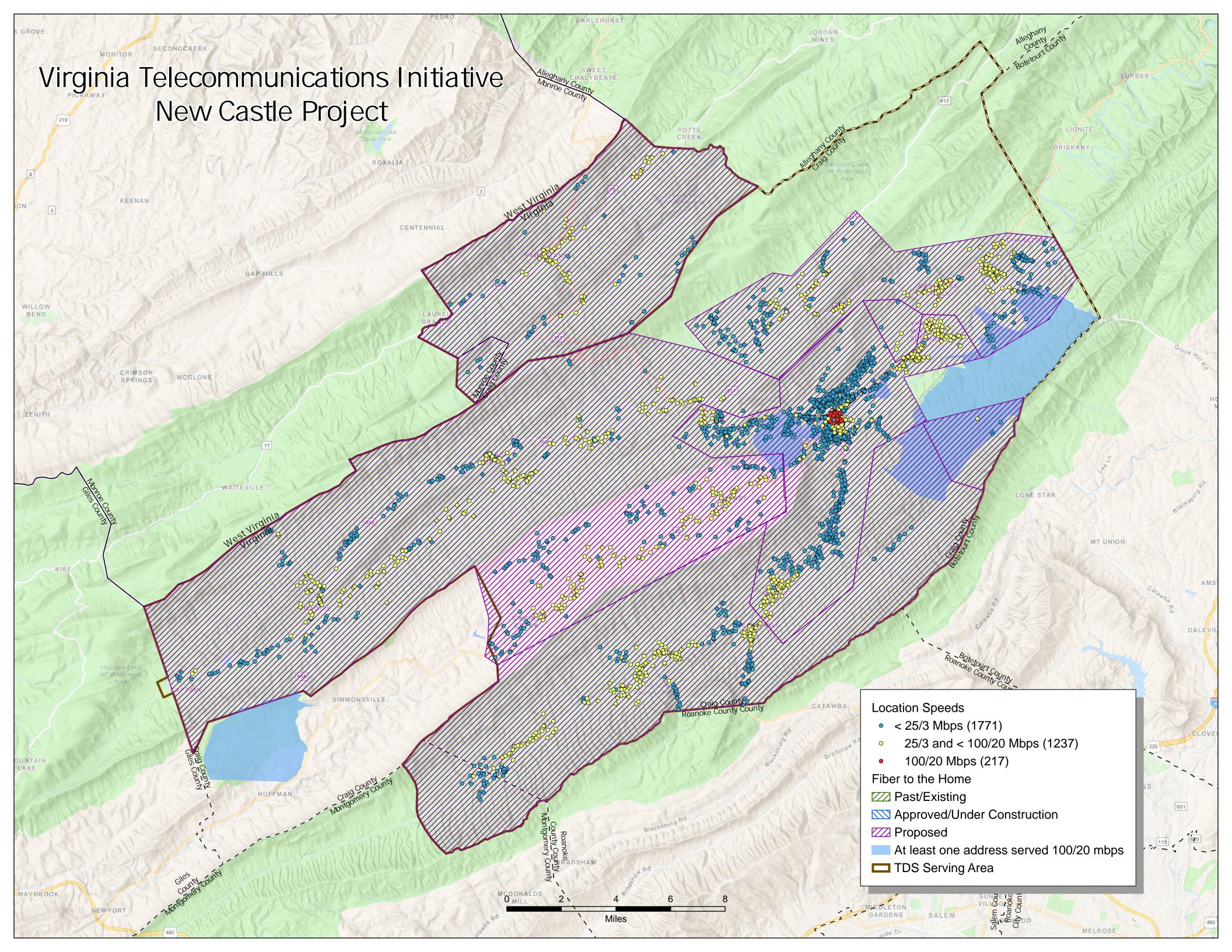
CraigCountyBroadbandStudyfinal8252022111602.pdf

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# 2023 Virginia Telecommunication Initiative (VATI) Passing Form

Type of Passings	Total Number of Passings in the Project Area <sup>1</sup>	Passings in the Project Area, without Special Construction Costs Required <sup>2</sup>	<b>Construction Costs budgeted</b>	Number of Passings with Speeds at 25/3 or below in Project Area <sup>4</sup>
Residential	2,726	2,726	0	1200
Businesses (non-home based)	88	88	0	26
Businesses (home-based)	59	59	0	17
Community Anchors	12	12	0	6
Non-residential	0	0	0	0
Total	2,885	2,885	0	1,249

**Note**: The Total Number of Passings <u>MUST</u> be equal to the Residential, Business (non-home based), Non-residential and Community Anchors sum.

**Note**: Do not include passings in RDOF awarded areas that were awarded to the co-applicant; these passings should be included in the RDOF Passings Form. Passings included in this application in RDOF awarded areas that were not awarded to the co-applicant, unless successfully challenged, are considered unserved and should be counted as passings in this form.

<sup>&</sup>lt;sup>1</sup>The total number of structures in the project area that can receive service. See definition of passing below for more detail.

<sup>&</sup>lt;sup>2</sup>The number of structures in the project area that will not require special construction costs to provide service to. These passings fall within the broadband provider's standard service connection drop length and do not require nonstandard equipment or any additional fees above normal service connection fees required to provide broadband access to a premise.

<sup>&</sup>lt;sup>3</sup>The number of structures in the project area with all construction costs budgeted in the application. These passings will not require any additional special construction costs beyond those budgeted for in the VATI application.

<sup>&</sup>lt;sup>4</sup>The number of structures in the project area that do not have access to internet at speeds of at least 25 mbps download and 3 mbps upload.

#### **Definitions**

**Passing** – any structure that can receive service. Multi-unit structures may be counted as more than 1 passing, provided individual connections and account are planned at that structure.

**Business** – An organization or entity that provides goods or services in order to generate profit. Businesses based in residential homes can count if they are a registered business (BPOL, LLC, etc.).

**Community Anchor** - schools, libraries, medical and health care providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and agencies that provide outreach, access, equipment, and support services to facilitate greater use of broadband service by vulnerable populations, including low-income, unemployed, and the aged.

**Non-Residential Passing** – places of worship, federal, state, or local facilities or other potential customers that are neither a residence, business or a community anchor as defined above.

# 2023 Virginia Telecommunication Initiative (VATI) RDOF Passings Form

Type of Passings	Total Number of Passings in the Project Area that lie within Preliminarily Awarded RDOF Areas <sup>1</sup>
Residential	0
Businesses (non-home based)	0
Businesses (home-based)	0
<b>Community Anchors</b>	0
Non-residential	0
<b>Total Number of RDOF Passings</b>	0

**Note**: The Total Number of RDOF Passings <u>MUST</u> be equal to the Residential, Business (non-home based), Non-residential and Community Anchors sum.

#### **Definitions**

**Passing** – any structure that can receive service. Multi-unit structures may be counted as more than 1 passing, provided individual connections and account are planned at that structure.

**Business** – An organization or entity that provides goods or services in order to generate profit. Businesses based in residential homes can count if they are a registered business (BPOL, LLC, etc.).

**Community Anchor** - schools, libraries, medical and health care providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and agencies that provide outreach, access, equipment, and support services to facilitate greater use of broadband service by vulnerable populations, including low-income, unemployed, and the aged.

**Non-Residential Passing** – places of worship, federal, state, or local facilities or other potential customers that are neither a residence, business or a community anchor as defined above.

## **TDS Telecoms Craig County Project Plan**

- Grant Application / Award start 09/2022; complete 12/2022
- OSP Engineering start 01/2023; complete 03/2023
- ISP Engineering start 01/2023; complete 03/2023
- Contracts start 03/2023; complete 06/2023
- Supply Chain & Procurement start 04/2023; complete 04/2024
- ROW/Permitting start 01/2023; complete 04/2024
- OSP Construction start 08/2023; complete 09/2024
- ISP Construction start 10/2023; complete 06/2024
- ISP Backhaul start 10/2023; complete 06/2024
- Market Readiness start 07/2024 complete 09/2024
- Project Completed 09/2024

# MEMORANDUM OF UNDERSTANDING BETWEEN THE COUNTY OF CRAIG, VIRGINIA, AND TDS TELECOM FOR APPLYING FOR VIRGINIA TELECOMMUNICATIONS INITIATIVE FUNDING FOR PROVIDING BROADBAND SERVICES

#### **I. PARTIES AND PURPOSE**

This Memorandum of Understanding (MOU) is made and entered into as of the \_\_\_\_\_ day of September 2021, by and between Craig County, Virginia (the "County"), a political subdivision of the Commonwealth of Virginia, and New Castle Telephone Company d/b/a TDS Telecom ("TDS"), for the purpose of creating a partnership to prepare and submit an application for grant funding through the Virginia Telecommunications Initiative (VATI) the Virginia Department of Housing and Community Development in an effort to expand and improve broadband services to the citizens of Craig County, Virginia. The County recognizes that in order to attain and maintain a high-quality level of broadband service to the citizens of Craig County, a close working relationship with the private internet providers is desirable and will be made possible in large part through state and federal grant funding opportunities. The County wishes to make a grant application with New Castle Telephone Company d/b/a TDS Telecom for the purposes of incentivizing TDS to expand its facilities in Craig County, increase jobs and employment, enhance learning opportunities for students, and otherwise expand the tax base of the County.

#### II. SCOPE OF WORK

The County and TDS desire to cooperatively work together to prepare and apply for grant funding through the 2023 Virginia Telecommunications Initiative (VATI) Funding Program managed by the Virginia DHCD to provide fiber broadband service in several areas of the County by building out a fiber to the home network encompassing the totality of their existing coverage area in the County. The application for funding anticipates coverage to be made available to 2,885 households and businesses in the County that are currently unserved/underserved. Service is envisioned to be provided through a Fiber-To-The-Home design.

TDS agrees to provide the certain agreed funding, in addition to the VATI awards, to construct the projects above to deliver internet service to the homes/businesses in these areas by providing internet speeds up to 2 Gbps. The total cost of this project is estimated at \$7,594,921.

To obtain necessary project funding, the County agrees to complete a grant funding application, with assistance from TDS through the DHCD VATI Funding Program requesting \$4,556,952 to be allocated to the above project. TDS agrees to provide the remaining project funding up to \$3,037,969 to complete the above projects.

The parties confirm that a detailed agreement shall be executed if funding is approved to outline all the obligations of the County and TDS and providing performance guarantees for service delivery and maintenance. If funding is approved from DHCD, the parties confirm and understand that TDS will be responsible for providing the funding up to \$3,037,969 to complete the project for which DHCD funding was received.

If the combination of TDS funding and the Grant amount is not sufficient to complete service to all of the addresses contemplated, TDS will be required to complete only so much of the project as is feasible with the available funding. The parties will seek additional funding or other relief with respect to the shortfall in funding.

Either party may reject the grant award if the award imposes conditions that the party, in its sole discretion, finds unacceptable. If the award is accepted, TDS agrees to eliminate the requirement for Internet subscribers to acquire landline telephone service when subscribing to a fiber based broadband services.

Signatures on following page

IN WITNESS WHEREOF, the parties have executed this Memorandum of Understanding on the day, month, and year indicated:

FOR CRAIG COUNTY, VIRGINIA:	
By:	
Robert Collins	
County Administrator	
COMMONWEALTH OF VIRGINIA	
COUNTY OF CRAIG, to wit:	
The foregoing instrument was acknowledged before me this day of	_, 2022 by
Robert Collins, on behalf of Craig County, Virginia.	
My commission expires	
Registration No	
FOR THE BROADBAND COMMITTEE OF CRAIG COUNTY:	
By:	
Salvatore Bellassai	
Chairman	
COMMONWEALTH OF VIRGINIA	
COUNTY OF CRAIG, to wit:	
The foregoing instrument was acknowledged before me this day of	_, 2022 by
Salvatore Bellassai on behalf of the Broadband Committee of Craig County, Virginia.	
My commission expires	
Registration No	
FOR TDS TELECOM:	
By:	
Bruce Mottern	
Manager, State Government Affairs	
THE STATE OF TENNESSEE	
COUNTY OF KNOX, to wit:	
The foregoing instrument was acknowledged before me this day of, on behalf of TDS.	_, 2022 by
My commission expires	
Registration No	

Source	Amount	%	Status
Requested VATI	\$4,556,952	60	Pending
Private	\$3,037,968	40	Confirmed
Total	\$7,594,921	100	



August 25, 2022

Ms. Tamarh Holmes, Ph.D.
Director, Office of Broadband
Department of Housing and Community Development
600 East Main, Ste 300
Richmond, VA. 23219

Dear Ms. Holmes,

New Castle Telephone Company, dba TDS Telecom commits to provide \$3,037,969 (40%) of match funding for the VATI 2023 Craig County application if awarded. These secured matching funds will come from general funds. TDS Telecom is helping to obtain universal broadband coverage in Craig County, for areas without 100/20 minimum broadband service, with this fiber-to-the-home project which will be capable of delivering 2Gbps symmetrical speeds to all locations in its service area.

Source	Amount	Percentage	Comment
Requested VATI grant	\$4,556,952	60%	Request pending
TDS Telecom	\$3,037,969	40%	Secured general funds
Total	\$7,594,921	100%	

Sincerely,

/s/ Bruce Mottern

Bruce Mottern Manager – State Government Affairs TDS Telecom (O) 865-671-4753

Email: bruce.mottern@tdstelecom.com

#### CDBG Derivation of Cost

Product	Total	VATI	Non-VATI	Source of Estimate	Date
EXAMPLE					
Construction					
200 LF of fiber @\$150/LF	\$30,000	\$15,000	\$15,000	Company A	9/5/2016
Tower	\$100,000	\$80,000	\$20,000	Company B	9/5/2016
Engineering	\$20,000	\$0	\$20,000	ABC Engineering Firm	9/5/2016

Product	Total	VATI	N	Ion-VATI	Source of Estimate	Date
Calix E7-2 GPON-8	\$ 235,281	\$ 141,169	\$	94,112	Internal engineering estimates	6/31/2022
Construction Costs	\$ 1,283,580	\$ 770,148	\$	513,432	Internal engineering estimates	6/31/2022
Aerial Fiber Optic Cable	\$ 2,800,827	\$ 1,680,496	\$	1,120,331	Internal engineering estimates	6/31/2022
Buried Fiber Optic Cable	\$ 3,275,232	\$ 1,965,139	\$	1,310,093	Internal engineering estimates	6/31/2022
	\$ -	\$ -	\$	-		
	\$ -	\$ -	\$	-		
	\$ 1	\$ -	\$	-		
	\$ -	\$ -	\$	-		
	\$ -	\$ -	\$	-		

#### CDBG Derivation of Cost

\$ -	\$ -	\$ -	
-	-	\$ -	
\$ -	\$ -	\$ -	
\$ -	\$ -	\$ -	
<b>\$</b> -	<b>s</b> -	\$ -	
-	<b>s</b> -	\$ -	

#### **Attachment 13 Documentation Supporting Project Costs**

TDS Telecom will deploy a FTTH (Fiber to the Home) network using Gigabit Passive Optical Network (GPON) technology. GPON can deliver 2Gbps symmetrical speeds with all customers that have access to the fiber. Given that fiber is in general maintenance free, the FTTH network will provide the company with a platform to scale as successive generations of optical technology become available and meet the consumer's ever-increasing demands for bandwidth. Traffic will be aggregated in the company's central office on an IP (Internet Protocol) router where it will be transported to the company's IP core network through leased backhaul facilities. The company manages its network to the capacity needs of its subscribers and does not use pre-determined over subscription or per subscriber bandwidth usage assumptions for maintaining its networks. TDS Telecom has extensive experience in deploying broadband networks to rural customers. TDS Telecom's Senior Management is fully capable of building, operating, and maintaining the network infrastructure proposed in this application, as a natural extension of its 50 plus years of service. We have a solid performance record in delivering advanced communications solutions to a wide and diverse customer base of rural areas, including 108 subsidiaries (including 3 in the state of Alabama) serving 1.2M customers from its Incumbent Local Exchange Carriers (ILECs) serving primarily rural commercial and residential customers in nearly 900 communities across the United States.

Considering this capacity and experience TDS Telecom has a internal supply chain to reliably assure out costing estimates based on bulk purchase agreements and other incentive plans from vendors. Also in this attachment are detailed descriptions of electronic OSP devices that are commonly utilized in our network designs. Both assets exceed the requirements for broadband speed and are scalable in the future.



## COMMONWEALTH OF VIRGINIA HOUSE OF DELEGATES RICHMOND

COMMITTEE ASSIGNMENTS:
HEALTH, WELFARE AND INSTITUTIONS (VICE-CHAIR)
PRIVILEGES AND ELECTIONS
COMMERCE AND ENERGY
RULES

August 15, 2022

To Whom It May Concern,

I write today in support of Craig County's Virginia Telecommunication Initiative grant application which would extend universal access to broadband to Craig County households.

The COVID-19 pandemic highlighted our society's reliance on broadband internet access across many facets of our daily lives—from employment and business responsibilities, to educating our children, to staying connected to our loved ones. It also demonstrated the importance of reliable and quality connections to ensure that we can adequately take care of these responsibilities.

Individuals and businesses in rural areas, like Craig County, are often geographically barred from reliable, quality access. In today's environment, poor internet connectivity can significantly damage local economies, impair student learning, and isolate families. It is imperative that rural Virginians have the same opportunities to thrive as those in more populated areas of our Commonwealth.

Accordingly, I strongly support the Craig County Broadband Committee in their efforts to seek external funding to provide universal broadband coverage. I encourage the granting of their application for funding as this will help improve the quality of life—economically, educationally, and personally—for all Craig County residents.

Sincerely,

Delegate Chris Head

Virginia House of Delegates

17th District



August 15, 2022

#### Letter of Support for Craig County Broadband Committee's VATI Application

To whom it may concern:

I am writing to support the Craig County Broadband Committee's (CCBC) Virginia Telecommunications Initiative (VATI) application to fund a whole-county fiber plan for Craig County. Craig County is the most underserved portion of my district in terms of broadband access. According to a recent survey, sixty percent of Craig County residents are "dissatisfied" or "very dissatisfied" with their home internet speeds. Further, seventy-two percent of Craig County residents report having trouble using common internet services due to internet speeds, while thirty-four percent of Craig County residents indicate that availability of broadband internet is impacting where they choose to live in the future.

The slow internet speeds also impacted residents' ability to work. Sixty-two percent of Craig County residents report that they need better internet to enable working from home in response to the Covid-19 pandemic. Even employers are having trouble, as one-hundred percent of business respondents reported a need for better internet service.

Luckily, the Commonwealth by way of VATI can provide assistance. The whole county broadband proposal covers an estimated 3,253 households for just \$6,088,632 in state contribution. Thus, I am asking you to consider the approval of CCBC's application. This will also help to achieve Governor Youngkin's goal of universal broadband coverage by 2028.

Respectfully,

Joseph P. McNamara Virginia House of Delegates

good se Venan

Member, 8th District

### SENATE OF VIRGINIA

#### STEPHEN D. NEWMAN

23PO SENATORIAL DISTRICT
ALL OF BOTETOURT AND CRAIG COUNTIES;
PART OF BEDFORD, CAMPBELL, AND ROANOKE
COUNTIES; AND PART OF THE CITY OF LYNCHBURG
P.O. BOX 480
FOREST, VIRGINIA 24551
SNEWMAN®SENATORNEWMAN.COM
(434) 388-1065



COMMITTEE ASSIGNMENTS: COMMERCE AND LABOR EDUCATION AND HEALTH FINANCE AND APPROPRIATIONS TRANSPORTATION

August 15, 2022

Dr. Tamarah Holmes
Director, Office of Broadband
Virginia Department of Housing and Community Development
VATI Program
600 East Main Street, Suite 300
Richmond, VA 23219

Letter of Support for Craig County's 2023 VATI Application

Dear Dr. Holmes:

I am writing today in strong support of Craig County's VATI grant application for funding that will enable them to work with TDS Telecom and Pemtel to achieve universal fiber coverage in Craig County, Virginia.

I represent Craig County in the Senate of Virginia and am intimately familiar with the county's faithful efforts over the years to bring quality broadband service to its residents. Much of Craig County's beauty is because of its rural nature. Yet, for those who choose to live there, internet access is a constant struggle.

In my position as senator for this county in Virginia, I have done everything in my power to advocate for partnerships and opportunities for the county to find innovative ways to bring powerful broadband service to its residents. Approval for this grant will enable Craig County to achieve countywide broadband access to 3,253 households - a once in a lifetime opportunity.

It is my sincere hope that you approve this grant application and enable Craig County to take a huge leap into the 21<sup>st</sup> Century. Please feel free to contact my office if you need any additional information.

Sincerely.

Stephen D. Newman

# United States Senate

WASHINGTON, DC 20510-4606

August 17, 2022

COMMITTEES:

BANKING, HOUSING, AND URBAN AFFAIRS

**BUDGET** 

INTELLIGENCE

**RULES AND ADMINISTRATION** 

The Honorable Bryan Horn
Director
Virginia Department of Housing and Community Development

Richmond, VA 23219-2430

600 East Main Street, Suite 300

Dear Director Horn,

I write today in support of Craig County's grant proposal to the Virginia Department of Housing and Community Development's (DHCD) Virginia Telecommunication Initiative to assist with their whole-county fiber plan.

Broadband is a necessity in our world today. For too many Americans, particularly in rural communities, lack of access to affordable, high-speed internet is the barrier to being able to connect with health care providers online, participate in distance learning, or work from home. I understand that Craig County recently completed a broadband study that included a survey of business owners and residents. 100% of business owners reported a need for better internet coverage, and 40% of residents indicated that quality of internet service impacted where they choose to live. Community leaders understand the challenges that a lack of affordable, high-speed internet access creates, and on my recent visit to Craig County, they expressed that reaching universal broadband coverage is their priority.

I ask that you give this proposal every appropriate consideration. To the extent possible, please continue to update my office on the status of this grant by emailing GrantSupport Warner@warner.senate.gov.

Thank you for your service on behalf of my constituents.

Sincerely,

MARK R. WARNER

United States Senator

MRW/aw

ink R Wines

#### H. MORGAN GRIFFITH 9th DISTRICT, VIRGINIA

### COMMITTEE ON **ENERGY AND COMMERCE** SUBCOMMITTEES: OVERSIGHT AND INVESTIGATIONS REPUBLICAN LEADER

ENERGY

www.morgangriffith.house.gov



# Congress of the United States House of Representatives

Washington, **BC** 20515-4609

August 15, 2022

2202 RAYBURN HOUSE OFFICE BUILDING WASHINGTON, DC 20515 (202) 225-3861 PHONE (202) 225-0076 FAX

> 323 WEST MAIN STREET ABINGDON, VA 24210 (276) 525-1405 PHONE (276) 525-1444 FAX

17 WEST MAIN STREET CHRISTIANSBURG, VA 24073 (540) 381-5671 PHONE (540) 381-5675 FAX

Dr. Tamarah Holmes Director, DHCD Office of Broadband Virginia Department of Housing and Community Development 600 East Main Street, Suite 300 Richmond, VA 23219-2430

Dear Dr. Holmes,

I am writing to express my support in the grant application for the Virginia Telecommunications Initiative (VATI) through the Virginia Department of Housing and Community Development submitted by the Craig County Broadband Committee in Craig County, Virginia.

In preparing this grant application, the Craig County Broadband Committee cited many factors contributing to the need for this funding in my congressional district. I ask that you give this application your most thoughtful and serious consideration. If there is any additional information that my office can provide, please contact Josh Hess at my Christiansburg office at (540) 381-5671.

I would very much appreciate it if you would acknowledge receipt of this letter and keep me apprised of your action regarding this application when review is complete. You should respond to the Craig County Broadband Committee in care of my Christiansburg office at (540) 381-5671 by phone or by mail to 17 W. Main Street, Christiansburg, Virginia 24073.

Thank you for your time and attention to this matter. I look forward to hearing from you. I remain

H. MORGAN GRIFFITH Member of Congress

### To whom it may concern:

As a Craig County resident, and active public servant, I wish to endorse the idea of our County-wide Fiber plan that is being submitted for your consideration. As a New Castle Town council member, EDA board Member, and Chairman of Craig County Tourism, I have heard repeatedly from citizens the deep need for broadband. Our businesses are at a distinct disadvantage when their internet speeds are limited to a dial-up internet program that brings download speeds to a near halt. As the internet has grown as a vital part of everyday life the bandwidth required to be in business has expanded as well. Currently the majority of Craig County is unable to compete because it does not have access to high speed internet.

This plan that you are considering would allow Craig County businesses to communicate at the same speed as our larger, neighboring communities, thereby giving them a level, competitive playing field. As a County that is in close proximity to the largest City in Southwest Virginia, Roanoke, we consistently are in competitive business opportunities. When this occurs, speed is one of the factors that clients use to determine who they will ask to provide services to them. Because of the disparity of broadband speeds, Craig County businesses, who may be more qualified and skilled, still are at a distinct disadvantage due to our lack of internet infrastructure.

The plan before you would alleviate these businesses of that disadvantage and allow the talents of our residents to have a fair opportunity to earn the business.

Further, there is a reticence of new businesses opening in a community that has this disparity in broadband service. More and more skilled people are leaving our County to go where the broadband internet speeds allows them to be

competitive. This drains our County of talented individuals and further exacerbates our competitive disparities.

Finally, I would ask that you consider the broadband internet disparities and how it affects the students of Craig County. At this time, teachers are unable to send homework assignments that would require students to do any research on the internet. This stunts the educational opportunities our students have. With County-wide Fiber based broadband service this would allow our students to have access to the vast resources available on the internet for the purposes of furthering their education.

Thank you for considering Craig County's broadband proposal. It is my sincere hope that you will see that this plan could be a significant game changer for our community.

Yours truly,

Lenny Macdonald

New Castle Town Councilman Craig County Tourism Chairman



# COMMONWEALTH OF VIRGINIA VIRGINIA DEPARTMENT OF HEALTH

Cynthia B. Morrow, MD, MPH Health Director

Serving the Residents of:
Alleghany County
Botetourt County
Craig County
Roanoke County
City of Covington
City of Roanoke
City of Salem

Roanoke City and Alleghany Health Districts 1502 Williamson Rd. NE,2<sup>nd</sup>Floor Roanoke, VA 24012

August 9, 2022

To Whom it May Concern:

I am writing to share my enthusiastic letter of support for Craig County's Virginia Telecommunication Initiative grant application which would extend universal access to broadband to Craig County households.

Many valuable lessons were learned during the early days of the Covid-19 pandemic. As a local public health director, I saw firsthand how important universal broadband coverage was for all residents in our health districts. In addition to broadband being essential for educating our children when schools were closed, broadband was, and continues to be, essential to get good information out to every resident to empower them to make informed decisions about their health. Furthermore, with the expansion of telehealth as a means to increase access to healthcare, every household should be able to remotely connect with their healthcare professionals as needed to address their healthcare needs. Today, individuals without access to broadband are at a distinct disadvantage with respect to their health.

As a public health professional, I strongly support taking action to level the playing field through expansion of universal access to Craig County households. This is one concrete step that we can take to improve the physical, educational, and economic well-being of Craig County residents. For these reasons, I fully support the efforts of the Craig County Broadband committee as they seek external funding to provide universal broadband coverage and encourage the funding of this application.

Sincerely,

Cynthia B. Morrow, MD, MPH

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Health Director



# Craig County Department of Social Services Barbara Davis, Chair \* Jenette McClanahan, Vice Chair Susan Dillion \* Angela Huffman\*Angela Gardner Patricia Franklin, Director P.O. Box 330

New Castle, VA 24127 540-864-5117 \* 540-864-6662

8/8/22

DHCD 600 East Main Street, Suite 300 Richmond, VA 23219

Dear Sir:

It is with great pleasure that we submit this letter of support for Craig County's Virginia Telecommunication Initiative grant application which would extend universal access to broadband to Craig County households.

The lack of adequate or reliable broadband internet access effects our county across demographics. It has a negative impact on families and businesses alike. A survey recently completed by the Craig County broadband committee showed that 72% of Craig County residents report having trouble using common internet services due to internet speeds, 62% of Craig County residents report that they need better internet to enable working from home in response to the Covid-19 pandemic and 100% of business respondents reported a need for better internet service.

In conclusion, we fully support the efforts of the Craig County Broadband committee as they seek external funding to provide universal broadband coverage and encourage the funding of this application as it will improve the quality of education our students receive.

Sincerely

Pat Franklin

Director

Craig County DSS



## **Craig County Economic Development Authority**

August 12, 2022

### To Whom it May Concern

It is with great pleasure that we submit this letter of support for Craig County's Virginia Telecommunication Initiative grant application which would extend universal access to broadband to Craig County households.

Craig County's population is declining according to recent census data and this is greatly concerning as a small rural community. Reliable, fast, and affordable internet is directly connected to our growth and future success. According to a survey conducted within our community, 34% of Craig County residents indicate that availability of broadband internet is impacting where they choose to live in the future. While some families move out of Craig County in search of better internet connectivity, many families choose not to move here in the first place due to the constraints of a world heavily reliant on remote work.

In conclusion, we fully support the efforts of the Craig County Broadband committee as they seek external funding to provide universal broadband coverage and encourage the funding of this application. Enhanced broadband connectivity is essential to the modern economic fiber of our community.

Sincerely,

C. Jordan Labiosa

Chairman

Craig County Economic Development Authority



PO BOX 346 New Castle Va. 24127

August 10th, 2022

Craig County Emergency Services

321 Salem Ave

New Castle, Va. 24127

To Whom it May Concern,

Craig County Emergency Services is submitting this letter of support for Craig County's Telecommunications Initiative Grant, that would extend broadband services throughout the county.

All Emergency Services agencies would benefit with reliable broadband internet service as our EMS agencies will be able to send and receive data to the hospitals.

Critical patient information can be sent to the hospital for better patient care upon arrival at the receiving hospital.

The Craig County Sheriff's Office patrol deputies would benefit by installing computers into there vehicles to pull individuals data from the state's Virginia Criminal Information Network for officer safety.

Craig County Emergency Services fully supports Craig County's Broadband Committee as they seek funding to provide a much-needed service for Emergency Operations throughout Craig County.

Sincerely

Darryl Humphreys

Danyl & Humphreys

**Craig County** 

**Emergency Management/Services Coordinator** 

540-864-8978 CRAIGLIBRARY@SWVA.NET

August 16, 2022

To whom it may concern,

Craig County Public Library, Inc., a 501(c)(3) non-profit organization based in New Castle, Virginia, hereby submits its official support for Craig County's application for the Virginia Telecommunications Initiative (VATI) grant program.

Craig County Public Library's mission is to empower individuals and build our community by bringing people, information, and resources together. Our vision is to provide essential tools for building the community's prosperity through education, information, and social interaction. Out of our tiny library in New Castle, we work to ensure everyone in Craig County can access the tools they need – tools that, increasingly, can only be accessed via a strong internet connection.

In our beautiful and in many ways isolated mountain community, lack of access to the information and opportunity that broadband internet affords is perhaps the single most significant barrier to our county's prosperity. Many of our library patrons value the connectivity we provide above all the other services we provide; even after our doors close for the evening, cars consistently crowd our small lot, making use of the WiFi service that so many folks simply can't get at home. Whether for work, school, health, social connections, enrichment and lifelong learning, or simply for entertainment, reliable, robust, fast internet access is perhaps the most consistent, pressing need we hear from Library patrons, too many of whom simply do not have access to adequate internet service at their homes. While we at the Library are proud of our work which helps fill gaps in access, our vision of a connected, thriving community requires that all our County's residents have the means to effectively navigate an increasingly online world, ideally from the comfort of home as opposed to our parking lot.

Craig County's VATI application, if funded, would significantly benefit the mission of the Craig County Public Library, and the prosperity of our county as a whole. As such, the Library is happy to support the project in any way feasible, and we fully recommend the approval and full funding of the application as presented.

Signed,

Jeanette D. Warwick, Superintendent Jessica R. Belcher, Board Clerk Heather F. Duncan, Asst. Superintendent of Finance



Trace Bellassai, Chairman Faye Powers, Vice-Chairman Y. Kevin Altizer Darren Gilreath Walter Marsden

August 7, 2022

Craig County School Board 6 Alleghany Circle, New Castle, VA 24127

To Whom it May Concern:

It is with great pleasure that we submit this letter of support for Craig County's Virginia Telecommunication Initiative grant application which would extend universal access to broadband to Craig County households.

Many valuable lessons were learned during the early days of the Covid-19 pandemic, one of the most insightful was the lack of adequate or reliable broadband internet access at the homes of our students. When virtual learning became necessary many students in our public school system struggled to access the systems that were essential to their success due to poor internet connectivity. While we hope to never return to a heavy reliance on virtual learning as a primary means of education, all of our students are expected to utilize the internet to complete research tasks related to homework and other special projects.

In conclusion, we fully support the efforts of the Craig County Broadband committee as they seek external funding to provide universal broadband coverage and encourage the funding of this application as it will improve the quality of education our students receive.

Sincerely,

Salvatore J Bellassai III

**Chairman of the Craig County School Board** 



# COMMONWEALTH OF VIRGINIA HOUSE OF DELEGATES RICHMOND

COMMITTEE ASSIGNMENTS:
TRANSPORTATION (CHAIR)
APPROPRIATIONS (VICE-CHAIR)
RULES

NINETEENTH DISTRICT

August 8, 2022

Dr. Tamarah Holmes Director Office of Broadband Department of Housing and Community Development 600 East Main Street, Ste 300 Richmond, VA 23219

### Dear Dr. Holmes:

I am providing this letter of support for Craig County's project application to fund a whole-county fiber plan. This proposal will provide service to an estimated 3,253 households and aligns with Governor Youngkin's goal of universal broadband coverage by 2028.

Lack of broadband service is affecting the quality of life for Craig County residents, and a recent survey indicates the widespread dissatisfaction with what has become a 21<sup>st</sup> century need:

- 34% of residents believe that availability of broadband internet is impacting where they choose to live in the future.
- 72% of residents report having trouble using common internet services due to internet speeds.
- 62% of residents report that they need better internet to enable working from home in response to the Covid-19 pandemic.
- 100% of business respondents reported a need for better internet service.

The successful completion of this project will address these issues and place Craig County on a more equitable footing with other counties throughout the Commonwealth. For these reasons I strongly recommend this application.

Respectfully,

Delegate Terry L. Austin

19th House District

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M 11	1	15	
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vi 12	1	100	
	M 12 M 12 M 11 M 12 M 11 M 11 M 12 M 11 M 12 M 12	M 12 1 M 11 1 M 12 1 M 11 1 M 12 1 M 11 1 M 12 0 M 11 1 M 12 1 M 12 1 M 12 1 M 12 1 M 11 1 M 12 1 M 11 1 1	M 12 1 100 M 12 1 100 M 11 1 1 15 M 12 1 100 M 11 1 1 15 M 12 1 100 M 11 1 1 15 M 12 0 0 0 M 11 1 1 15 M 12 1 100 M 11 1 1 15 M 12 1 100 M 11 1 1 15 M 12 1 100 M 11 1 1 50 M 12 1 100 M 11 1 1 50 M 12 1 100 M 11 1 1 25 M 12 1 50 M 11 1 1 25 M 12 1 50 M 11 1 1 25 M 12 1 50 M 11 1 1 25 M 12 1 50 M 11 1 1 25 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 12 1 50 M 11 1 1 55 M 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

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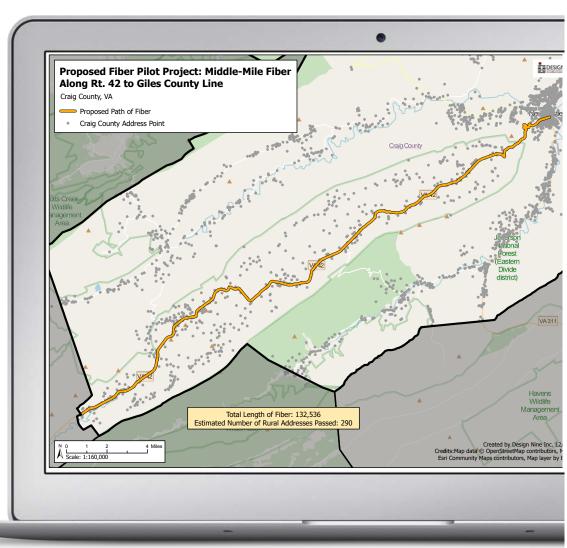
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# BROADBAND INFRASTRUCTURE OPTIONS

Craig County, Virginia





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#### Disclaimer

The telecommunications business is continually evolving. We have made our best effort to apply our experience and knowledge to the business and technical information contained herein. We believe the data we have presented at this point in time to be accurate and to be representative of the current state of the telecommunications industry.

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## 1 EXECUTIVE SUMMARY

A broadband study of Craig County began in the fall of 2021 and was completed in the winter of 2022. The study included meetings with stakeholders and interested parties in the county, interviews and meetings with businesses, meetings with county officials, and residential and business broadband surveys. The report has several key sections:

- **Technical and Asset Analysis** Demographic data, tower and fiber assets in the county, underserved and unserved areas of the county, and geo-coded survey results.
- Market, Current Use, and Gap Analysis A review of current service provider service offerings, speeds, and prices for those services and what bandwidth is available.
- Broadband Surveys In Craig County, both a residential broadband survey and a business broadband survey was distributed. A strong response was received.
- **Connectivity Solutions** This section provides an overview of various technologies, including both broadband wireless and broadband fiber.
- **Preliminary Design and Cost Estimates** Design and estimates of county-wide fixed point wireless network and fiber designs and cost estimates for three fiber projects.
- Infrastructure Funding and Grant Opportunities A discussion of a variety of grant and funding strategies.

The survey data collected as part of this study indicates that residents and businesses are anxious for better Internet service. Because a very large number of often passionate comments were received, they have been included in a separate document.

- 88% of respondents are interested in having access to Gigabit fiber Internet.
- 94% believe that local government should help facilitate better Internet access.
- 40% of residents report the quality of Internet service is affecting where they choose to live.
- 80% of businesses indicated that the Internet is important to the success of their business.
- 73% of businesses reported that they need employees able to work from home.

#### FUTURE-ORIENTED INFRASTRUCTURE

Affordable high speed Internet is essential to the future growth and prosperity of Craig County. Over the past twenty years, Internet access has evolved from a luxury to a necessity. School students need Internet access to complete homework and to study. Online shopping can save energy and make it easier for the elderly and homebound to obtain the needs of every day life. Telemedicine and telehealth services and applications is revolutionizing health care, reducing costs, and allowing older citizens to live independently longer.

More and more workers and business people are working from home, either on a part time or a full time basis, and the Covid crisis has highlighted the critical need for reliable high performance Internet service for work, learning, and access to health services. New work from home job opportunities are growing rapidly, but most of those jobs require reliable, symmetric Internet service to qualify.

Many business employees are already trying to work more from home more often (e.g. one or two days per week) to reduce travel costs. Some major businesses in other parts of the U.S. are actively planning to have 20% of their workforce work full time from home to reduce employee travel costs and office energy costs. Corporate employees working from home require high bandwidth services to be connected to the office network and to use corporate videoconferencing systems. These corporate network services often require 10-50 Megabit **symmetric** connections.

#### Broadband has become essential community infrastructure.

Just as communities had to take on the task of building and maintaining roads in the early twentieth century, communities must now provide digital road systems as a matter of community and business survival. These digital road systems must be designed with certain characteristics:

The communities of Craig County, with the right broadband infrastructure, can be attractive to an emerging new group of businesspeople and entrepreneurs that typically are well-educated, own their own businesses or work for large global corporations, and are making choices about where they lived based on family needs and interests, rather than business interests. This new breed of entrepreneurs and workers place a high value on the kinds of amenities that contribute to a good quality of life-traditional neighborhoods, vibrant downtown areas, a wide range of cultural and recreation opportunities, good schools, and a sense of place. These businesspeople and their families make relocation decisions based on quality of life only where there is abundant and affordable broadband, because broadband is the enabler of this new approach to personal and work life.

The Governors Task Force on Broadband Access has set aggressive goals for the state:

- By 2025, all homes and businesses should have access to 25 Mbps download and 3 Mbps upload speeds.
- By 2028, all homes and businesses should have access to 50 Mbps download and 10 Mbps upload speeds.
- By 2031, all homes and businesses in the state should have access to 100 Mbps download and 50 Mbps upload.

Given that the Covid crisis has created increased attention to fiber Internet service, these goals are modest. If Craig County can use ARPA funds, other grant opportunities, and some local funds to make carefully targeted passive infrastructure investments and to develop constructive public/private partnerships, most homes and businesses in Craig County could have Gigabit fiber service within the next four to six years.

#### Summary of Findings and Recommendations

**Develop a County-wide Broadband Strategy.** Use the findings and recommendations in this report to develop a multi-year set of goals that can be realistically achieved using a basket of local, state, and Federal funding. Commit to providing the grant writing resources needed to pursue every possible grant opportunity.

The County government should not become an Internet provider. Instead, it should focus on developing public/private partnerships by making targeted investments in passive broadband infrastructure like towers and dark fiber. These assets have long life spans of forty years or more and can be leased out to private sector ISPs (passive infrastructure leasing is not a telecommunications service). While the revenue from the lease agreements will be modest, the funds generated can be used to support maintenance of this infrastructure.

Improved and Affordable Fiber and Wireless is Needed. Many residents and businesses rely heavily on poor DSL Internet access and need an alternative. Improving service provider access to more towers in the rural and underserved areas of the county will support improved Internet service. Expanded fixed point broadband wireless service is a critical strategic short term goal in the county, but widespread access to wired fiber access is critical to the long term economic growth of Craig County county. Some investment in wider access to a middle mile dark fiber network may be needed to accelerate fiber to the home investment by ISPs and to improve performance and availability of fixed point wireless. Affordable access to a county-wide middle mile dark fiber network can also help accelerate the deployment of improved 4G and 5G cellular services to underserved areas of the county.

**Seek Grant Funds.** The Federal government has been steadily increasing the amount of grant funding available for broadband infrastructure, with USDA and HUD both having programs that are designed to help underserved and unserved areas construct new broadband infrastructure. Some Federal grant applications will be due in mid-spring of 2022, so planning for submitting grant proposals should begin in early January 2022. Covid relief funding (ARPA, American Rescue Plan Act) should also become available in early 2022. Because ARPA funding is expected to exceed the previous Covid funding program (CARES), Craig County's share of ARPA funds should be substantial and a portion of it could cover a large part of the needed broadband infrastructure improvements.

**Manage Expectations.** The current deficiencies in Internet access in the county took decades to develop, and the proposed improvements should be approached as a multi-year process, with an expectation of substantial improvements in access and availability in twelve to eighteen months.

**Develop partnerships with WISPs and ISPs.** WISPS and ISPs should be provided a copy of this report, and then be invited to meet to provide input on what infrastructure investments would enable them to expand service most efficiently. Local and regional WISPs may be able to provide insight into where towers are most needed and what they are willing to pay for tower space. WISP and ISP suggestions should help inform the broadband strategy for the County, noting that ISP/ WISP demands may not always match the long term broadband needs of businesses and residents.

**Develop a long term funding strategy.** Grants may not provide sufficient funds to reach the County's long-term goals. Evaluate longer term funding strategies, like using a special assessment, or implementing a very small increase in property taxes. Revenue would be earmarked exclusively

for broadband improvements. Expansion of broadband in Craig County will be most successful by recognizing that funding will come from a range of funding sources rather than a single source. Grants, public/private partnerships, some local funds, and other sources may all be needed to achieve success.

Grants can be extremely important in the early stages of an effort to support planning activities and/or to fund a first-phase build-out initiative. However, grants rarely allow spending on operational expenses. Grants should be used carefully as one-time cash injections to support very specific goals. Communities that have relied too heavily on "the next grant" as a key source of expansion or operational funding usually experience severe financial problems.

# 2 BROADBAND AS ESSENTIAL INFRASTRUCTURE

Governments build and manage roads, but don't own or manage the businesses that use those roads to deliver goods and services. There is true competitive pricing between competing service providers, and little or no government regulation is required.

The tremendous versatility of the Internet and the underlying technology bases now allows services that used to require their own, separate (analog) road system (voice telephony and TV services) to be delivered alongside other services like Internet access on a single, integrated digital road system.

If we managed overnight package delivery the way we manage telecom, UPS and Fedex would only deliver packages to residences and businesses where each delivery firm had built a private road for their exclusive use. We recognize immediately the limitations of such a business model-few of us would have overnight package delivery to our homes because the small number of packages delivered would not justify the expense of building a private paved road.

Before the rise of the automobile, most roads were built largely by the private sector. After cars became important to commerce and economic development, communities began building and maintaining roads because it became an economic development imperative to have a modern transportation system in communities.



Before the rise of the Internet, digital networks were built largely by the private sector. As broadband has become critical to commerce

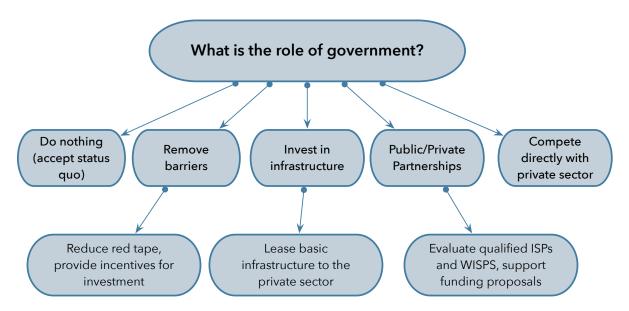
and economic development, communities with digital roads are more competitive globally.

The time has come to recognize that it is inefficient and wasteful to build full duplicated digital road systems, which only raise the cost of telecom services to all public and private users. Networks that share capacity among a wide variety of public and private users have a lower cost of construction and a lower cost of operation—benefiting all users.

A UTILITY COMPARISON				
SHARED ROADS	SHARED AIRPORTS	SHARED TELECOM		
Historically, roads have been built and maintained by the community for the use of all, especially private firms that want to use them to deliver goods and services.	Airports are built and maintained by a community or region as an economic and community development asset. Both public and private users benefit from the shared use of a single, well-designed airport	Duct and fiber may be installed and maintained by the community and/or a neutral owner/operator for the use of all, including private firms that want to use them to deliver goods and services.		
Access to the community road system is provided by parking lots and driveways, built by property owners, developers and builders.	Airport assets like departure gates, ticket areas, and runways provide access to the airline  Airport assets like departure across private property to community—wide network			
The local government uses roads only to deliver government services. Local government does not offer services like overnight package delivery.	While the local government or a consortium of local governments typically own the airport facility, the local governments do not offer flight services.	Local government uses the digital transport system only to deliver government services. Government does not offer services like Internet access or Voice over IP.		
Private sector businesses use roads so that their own cars and trucks can deliver goods and services to customers. Because businesses do not have to build and maintain roads, all businesses benefit directly by being able to reach more customers at less expense.	Private sector airlines are able to offer competitively priced airfares because of the shared cost of the airport terminal facilities. Each airline does not build its own airport (which would sharply increase the cost of airfare).	Private sector businesses use the digital transport system to deliver goods and services to customers. Because businesses do not have to build and maintain a digital road system, all service providers benefit directly by being able to reach more customers at less expense.		
There are no road connection fees, and anyone may connect to the road system for free. Governments pay for the cost of maintaining roads largely from those that use the roads . Fees are proportional to use, from taxes on tires and gasoline.	Businesses and citizens do not pay a fee to access the airport facility. The cost of maintaining the airport facility is paid by the airlines, which bundle that cost into the price of airfare. Fees are proportional to actual use by flying customers. Airlines benefit because they do not have to build, own, and operate the airport directly. Those costs are shared across all users.	Any qualified service provider may connect to the digital road system for a nominal fee and begin to offer services, without any significant capital expense. Network capital and operating costs are recovered by charging service providers a small fee that is based on a percentage of their income from services offered over the system.		

#### 2.1 WHAT IS GOVERNMENT'S ROLE?

Successful improvements in broadband access, affordability, and reliability for Craig County involves several decision points, as outlined in the illustration below. Government has several "first choice" options.



**Do nothing** is to accept that businesses and residents in the County will have to continue to use whatever is available, despite the cost and bandwidth limitations that limit what many are able to do online.

Government can **remove barriers** to private sector investment. This can be an effective and low cost strategy. Possibilities include reducing permit fees for fiber construction and tower installation, incentives to developers to install conduit and meet-me boxes in new residential and commercial construction, simplified permit requirements for utility pole installation on private property, and identifying areas of residential and business demand and sharing that information with providers.

The County can choose to **make investments in basic infrastructure** (e.g. a fiber network) and make that infrastructure available to the private sector via revenue-generating lease agreements.

The County can pursue **public/private partnerships** with technically qualified and financially stable ISPs and WISPs. Where appropriate, the County can channel grant funds to providers while will use the funds to build and manage new broadband infrastructure. Selected providers should be able to show technical competency and have a demonstrable track record of managing substantial fiber and/or wireless builds on time and within budget.

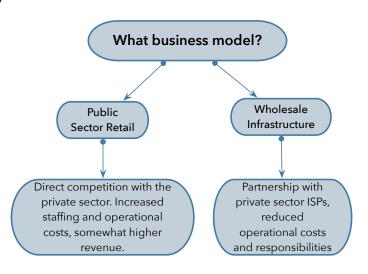
When communities have chosen the option to **compete directly with the private sector** by offering retail Internet, phone, and TV services lawsuits from incumbents often create difficulty moving forward as well as expensive legal fees.

#### 2.2 THE SHARED INFRASTRUCTURE BUSINESS MODEL

Traditionally, the telecom services market has been vertically integrated, with telephone and cable companies owning the cable infrastructure (i.e. twisted pair copper cable for telephone, and coaxial copper cable for TV). These companies bundled analog services with their own infrastructure, which made sense when only one service could be delivered over the cable.

American residents and businesses needed two networks: one for voice telephone service, and one for television. The rise of the Internet and associated changes in technology led to digital services (voice, video, Internet) that could be delivered simultaneously over a single cable or wireless connection.

By the early 2000s, it was becoming apparent that it was inefficient and costly to have two competing "retail" cable systems (e.g. telephone, cable) delivering the same content and services—it was only creating higher costs for residents and businesses.



A new business model became possible: wholesale leasing of the cable/wireless infrastructure to private sector service providers, which unbundles the infrastructure from the services. A side effect of this unbundling is that it becomes much easier to determine what a customer is actually paying for a given service: in the vertically integrated 20th century model, with the cost of infrastructure maintenance bundled together with the services, it is much more difficult to determine what a service actually costs.

While a few communities have pursued the retail business model (typically building fiber to the home and business and selling retail Internet and other services directly to customers), most of these retail efforts have been by local governments that are also providing electric service—owning the utility poles is a significant cost advantage not available in most communities.

Within the wholesale business model, there are several different ways to generate revenue.

**Passive Infrastructure Leasing** – In this approach, the County makes investments in a few targeted passive infrastructure types, typically broadband towers, and optionally conduit and dark fiber. This kind of basic infrastructure has virtually no day to day maintenance and management responsibilities, and can be leased out to private sector Internet providers so that those companies can expand their service area and service quality more rapidly.

**Lit Circuit Wholesale** – In this approach, the network provides lit fiber circuits to providers, with one circuit allocated to each customer. Service providers are charged for the cost of each circuit. Service providers are responsible for their own customers and their own customer billing. Revenue is based on the number of customers who actually buy service (the take rate). Revenue is dependent on the marketing success of the service providers.

**Utility Fee Wholesale** – In this approach, every household and business in the community pays a monthly small utility fee. Service providers pay only a small fee for use of the network that is based on the total number of potential customers. In this model, the effective take rate from a revenue perspective is 100%. With this high take rate, the individual utility fee can be very modest because everyone pays something, rather than just those buying a service.

Features	Municipal Retail	Wholesale Infrastructure
Basic Concept	Generally more difficult to because of possible legal challenges from incumbent providers. Generally not an option in Massachusetts.	One or more private sector ISPs would use the infrastructure to sell their own services directly to residents and businesses. Can be a dark fiber approach, lit fiber approach, and/or wireless towers.
Government Involvement	Local government competes directly with the private sector for Internet service.	County involvement is limited to providing basic infrastructure to ISPs.
Management	Local government is responsible for management and operations. Most functions could be outsourced to a qualified third party entity.  ISPs responsible for virtually all day to do customer services and support. County responsible for network and tower main and repairs.	
Competition	The incumbent telephone and cable providers would compete vigorously against local government service offerings.	Private sector ISPs would provide competition to the telephone and cable companies.
Service Options	residents could get TV and some other service offerings like	
Risks	The primary risk would be lawsuits from incumbent providers.	The lit network approach requires hard-nosed business management experience. It is important to identify prospective service providers early in the process.

In the wholesale infrastructure business model, local government investments are limited to basic transport infrastructure, including conduit, fiber, and network equipment. Services for businesses and residents are offered by private sector providers offering Internet, TV, telephone and other data services.

#### 2.3 SERVICE PROVIDERS AND SHARED INFRASTRUCTURE

The wholesale infrastructure model, where the local government is NOT selling retail telecommunications services, has been resistant to legal challenges, with at least one hundred communities in the U.S. that lease infrastructure to private sector service providers. Communities that have been challenged in court are ones that chose to pursue the retail model, with customers purchasing retail services like Internet, TV, and phone directly from the town or city government.

Lafayette, Louisiana is one of the best known examples. The City of Lafayette was sued by the incumbent telephone and cable company and won in court. The project is now more than ten years old, passed a 40% take rate target in 2017, and has begun expanding service outside the City limits. The City had a key advantage when starting the effort, because it is an electric city; owning the pole structure and being able to deploy the less expensive aerial fiber widely gave the project a distinct cost advantage.

The service providers that are usually most eager to become providers on a community-owned network are smaller local and regional providers. WISPs (Wireless Internet Service Providers) are usually quick to see the advantages of being able to deliver a superior Internet service over a modern fiber infrastructure with little or no capital expense on their part.

Once a community-owned network is under construction, it is typical that the incumbents, particularly the cable companies, begin lowering rates and offering special deals to customers to try to lock them in to multi-year contracts. There are two ways to approach this:

- If the announcement of construction of community-owned infrastructure lowers prices and improves service from the incumbents, that is an economic benefit to the citizens and businesses of the county. The new network, bringing new providers and a wider range of packages and pricing to citizens and businesses, creates the needed competition that motivates the incumbents to provide better prices and service.
- If the County does move forward, a modest but well through out information and education campaign about the benefits and advantages will be important to counter mis-leading information from the incumbents. Part of the effort must be to let citizens and businesses know not to sign long term contracts with the incumbents.

## 3 TELECOM ENVIRONMENT ANALYSIS

A wide variety of assets in Craig County are identified in the following pages.

The included maps provide detail on the following:

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

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

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

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

**Fiber Routes** – In most areas of the county, fiber routes are typically long haul routes passing through the county to other major metro areas and/or connecting only a few institutional and enterprise customers. Companies like Segra and Level3 have some local fiber available for business and institutional customers.

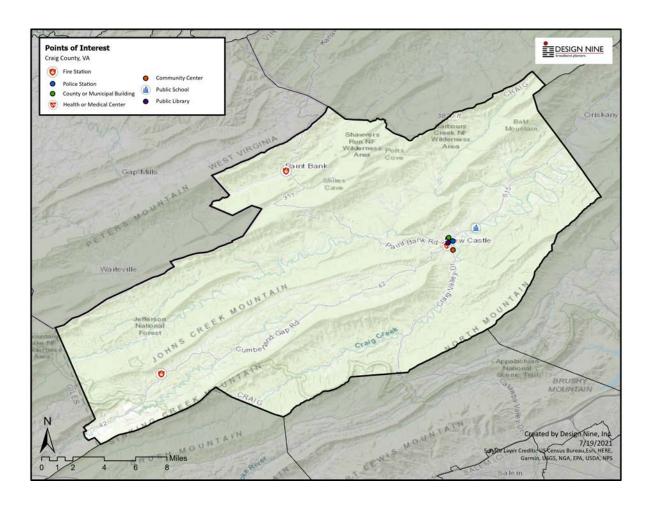
**Service Levels** – This map illustrates information on served, underserved, and unserved areas in the county obtained from FCC 477 reports. The data is self-reported by the service providers.

**Cellular Coverage in the County** – This data has been developed from data provided to the FCC by the cellular companies.

**RDOF Awards** – This map shows the recent RDOF (Rural Digital Opportunity Fund) awards made in Craig County.

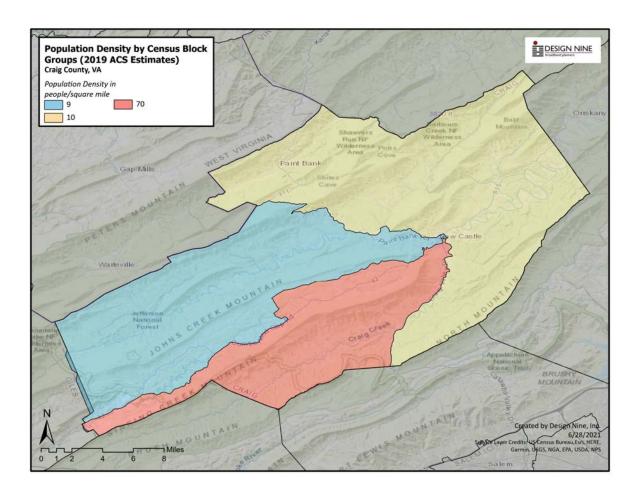
### 3.1 POINTS OF INTEREST

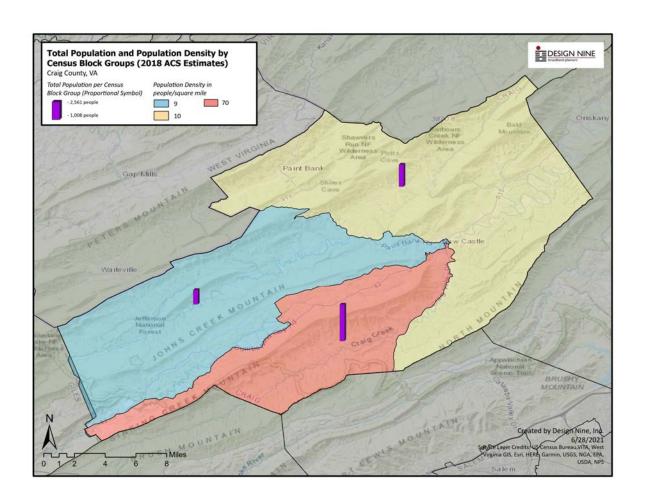
County facilities, municipal facilities, libraries, K12 and higher education facilities, fire and rescue stations, and public safety locations are all candidates to be anchor tenants for fixed point wireless and/or fiber services.



#### 3.2 POPULATION AND DENSITY DISTRIBUTION

This map shows the population and density distribution in the county, by census block. This information can be helpful when working with service providers and when trying to identify what technologies are most appropriate for various areas of the county.

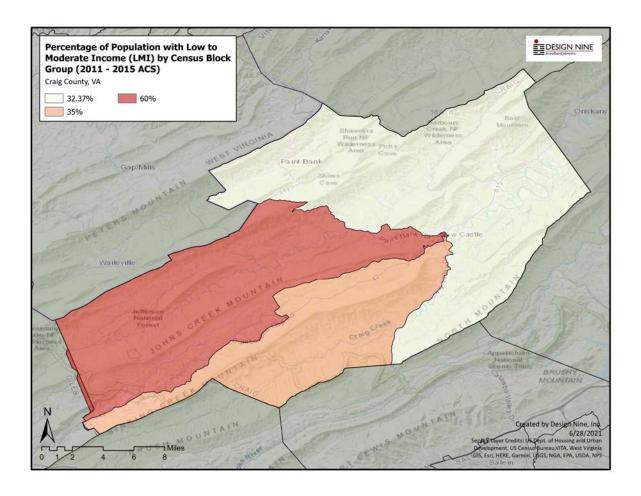


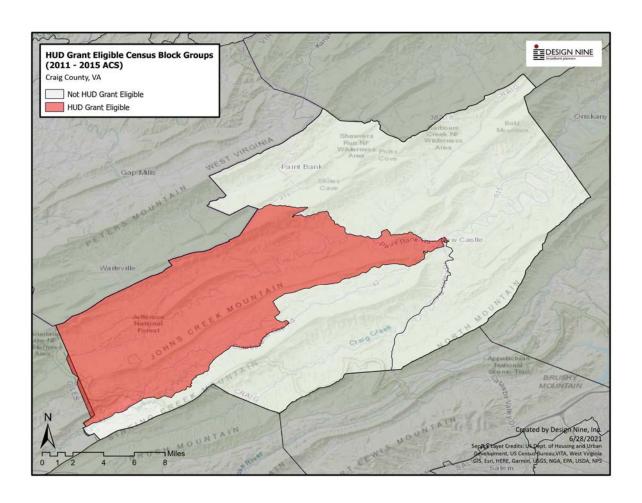


### 3.3 LMI AND HUD ELIGIBLE AREAS

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

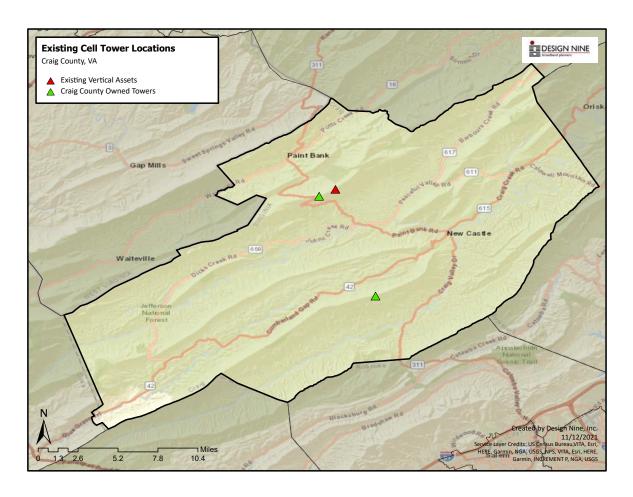
**HUD-eligible census blocks can qualify for CDBG funding for telecom infrastructure projects.** 





#### 3.4 TOWERS IN THE COUNTY

A variety of publicly-owned and privately owned towers are shown here. Tower data is collected from an FCC database, County data, and other public and commercial data sources. The FCC database usually includes most towers that are in a locality, and generally includes all or nearly all cellular towers. Tower ownership data is not always updated in a timely manner in the FCC database.



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

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

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

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

This table provides additional detail on tower owners and tower locations. Height of the towers is in meters, as that is the way the Federal Communications Commission requires towers to be registered in their database. Not all companies provide the height of their tower when registering it.

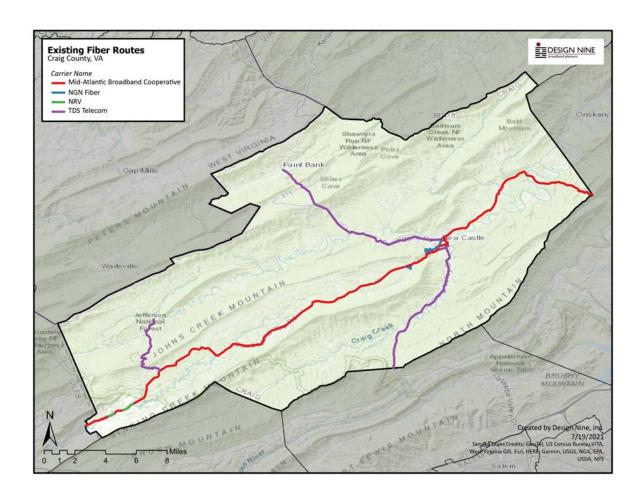
FCC Registration Number	Tower Owner	Height (meters)	Street Address	Latitude	Longitude
NA	Craig County - Sinking Creek Tower	Not available	Sinking Creek	37.442049	-80.179553
NA	Craig County - Potts Mtn Rd Towe	Not available	Potts Mountain	37.535993	-80.232664
1023983	American Tower	76.5	1197 Potts Mtn Trail East, New Castle VA	37.5425	-80.2173

#### 3.5 FIBER ROUTES IN THE COUNTY

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

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

Craig County has one TDS east-west fiber route that is likely used to provide voice and DSL service. The MBC route is part of a longer Roanoke-Blacksburg route, with some access to the fiber in New Castle. MBC does not provide any retail services.



#### 3.6 SERVED, UNDERSERVED, AND UNSERVED AREAS

The areas on the map below have been identified using FCC (Federal Communications Commission) 477 data. The map also shows the three areas (outlined in red) where fiber pilot studies were done as part of this work (see Section 7). Service providers, including incumbent telephone and cable companies, file a 477 report with the FCC to identify where their service is available and at what speed, using the FCC designations:

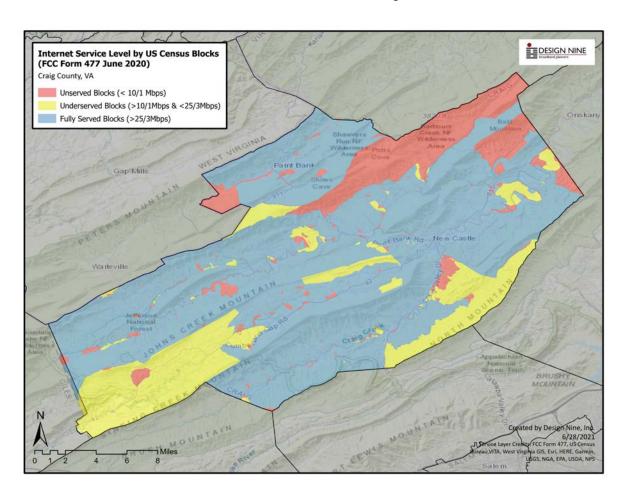
**Unserved** – Less than 10 Megabits down/1 Megabit up

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

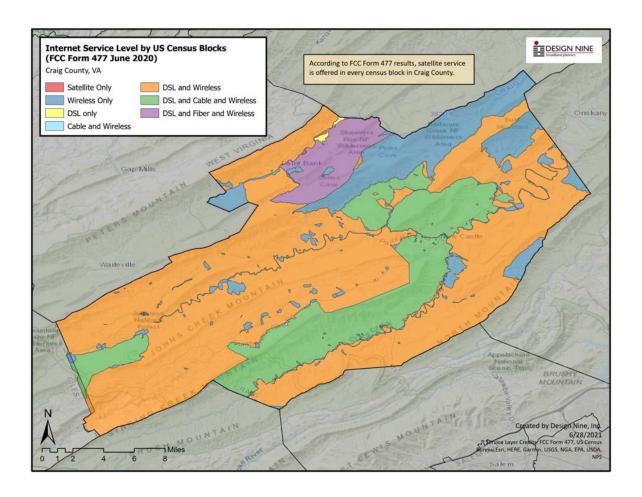
**Served** – Equal to or better than 25 Megabits down/3 Megabits up

There are two problems with the 477 data:

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



While the FCC data indicates that the entire county is fully served, there is wide variance in the kind and type of service available to households in the county. Fixed point wireless Internet is not widely available, and in most areas of the county, DSL is the primary service.

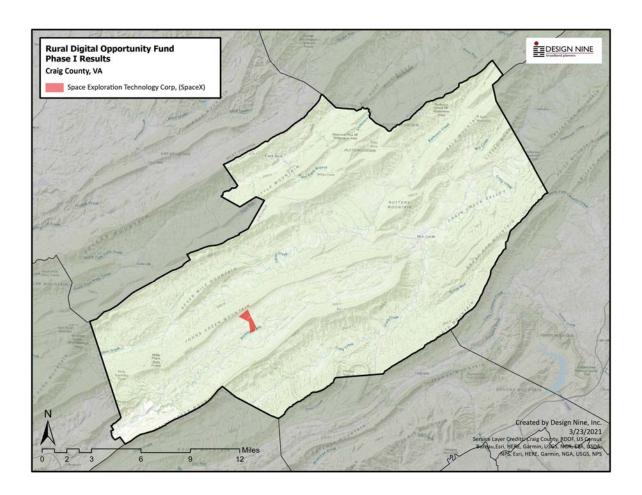


#### 3.7 RDOF AWARDS IN THE COUNTY

The map below shows the recent RDOF (Rural Digital Opportunity Fund) awards made in Craig County.

RDOF awards are made over a ten year period, with the funds released 10% at a time each year. Once an RDOF award is made for a particular area, no further RDOF funds will be awarded in that area for ten years. The long timeline for RDOF expenditures means that some areas that are included in the award may not receive upgraded service for nearly a decade.

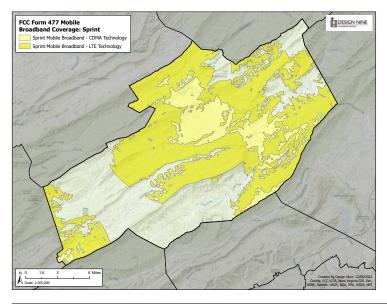
While SpaceX was awarded only a very small area of the county for its Starlink system, it should be noted that this is low earth orbit (LEO) Internet, and is not a terrestrial network. Starlink customers have to have a small satellite disk installed to receive the service. Reports from beta testers of the Starlink service have been generally positive, and the service is substantially better than the traditional geosynchronous satellite Internet that has been available for many years. For remote rural customers that have long driveways and/or are in remote areas of the county, Starlink can provide much improved broadband Internet access.

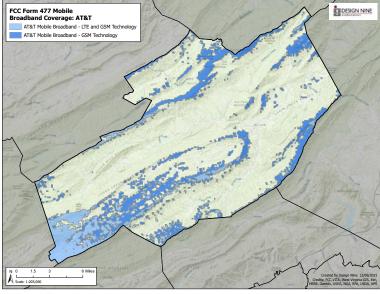


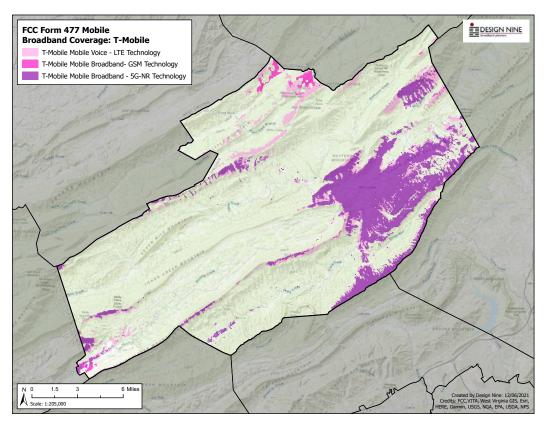
#### 3.8 CELLULAR COVERAGE IN THE COUNTY

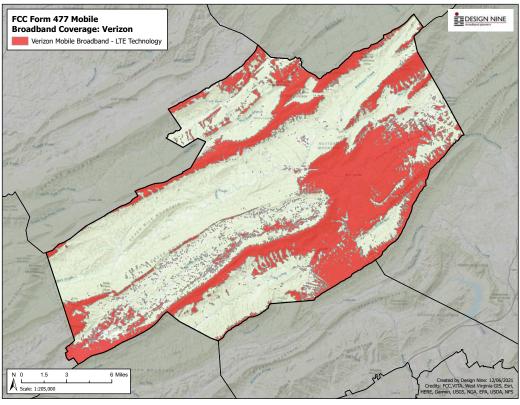
The maps below and on the following pages show the cellular voice and data coverage in the county from the four largest providers. The data is taken from the FCC, and the cellular providers self report their coverage – which is often optimistic. Cellular data coverage is nearly identical to the voice coverage. Large areas of the county lack cell service. This could be addressed in part by widespread availability of good Internet service and the use of WiFi calling, which is now available in nearly all smartphones—in other words, better broadband will also improve voice cellphone service without having to add more cell towers.

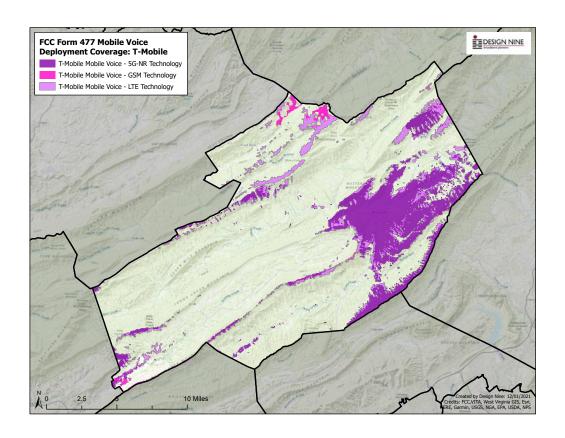
Large areas of Craig County have no cellular coverage; better broadband connectivity could address this problem for many homes and businesses that could use WiFi calling on their phones. Most late model smart phones support this.

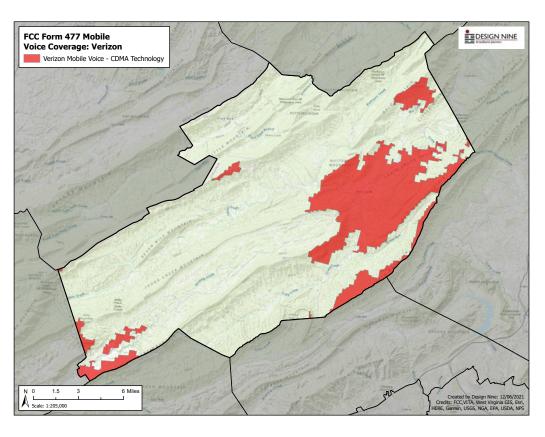


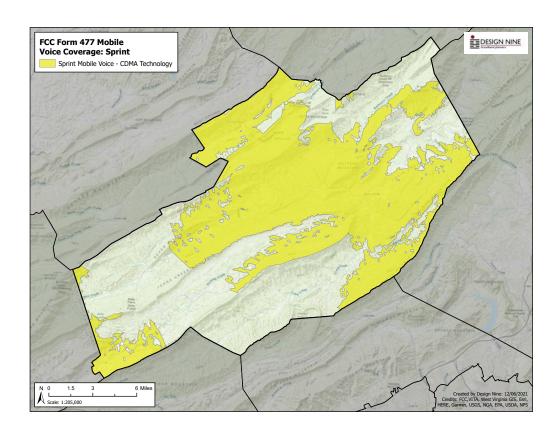


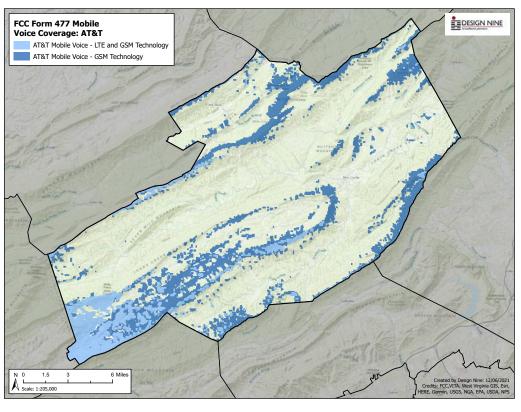












# 4 SERVICE PROVIDER ANALYSIS

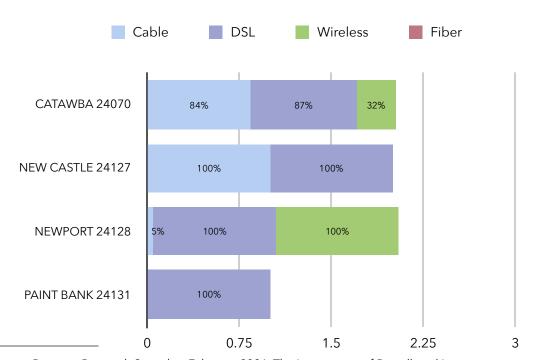
In a February 2021, Consumer Reports Survey, 75% of Americans said they need uninterrupted access to the Internet seven days a week<sup>1</sup>. Pew Reach Center recently reported that during the pandemic, "connection quality has been important for school assignments, meetings and virtual social encounters alike. The new survey highlights difficulties for some: Roughly half of those who have a high-speed internet connection at home (48%) say they have problems with the speed, reliability or quality of their home connection often or sometimes.<sup>2</sup>"

Nationally, Consumer Reports found in their Summer 2021 Broadband Survey, "Fifteen percent of American households only have access to the internet through their smartphone data plan and one in 20 use DSL or dial-up to access the internet. Three percent of Americans say their household does not have access to the internet."

Our first chart shows estimates of available broadband technology types in Craig County. The following information shows citizens get Internet service in Craig County and how much they pay for it. We were unable to verify either SuddenLink or Verizon services in Craig County;

Our data is assembled from public sources, Decision Data which combines FCC data and data from social media and Broadband Now. Zip code boundaries are not aligned with local government jurisdictions, and some zip code data may include areas outside the county. The information in these charts is current as of September 2021.

#### Estimates of available broadband technology type in the county



<sup>&</sup>lt;sup>1</sup> Consumer Reports- Research Snapshot February 2021, The Importance of Broadband Internet

<sup>&</sup>lt;sup>2</sup> The Internet and the Pandemic, Page 1 https://www.pewresearch.org/internet/2021/09/01/the-internet-and-the-pandemic/

<sup>&</sup>lt;sup>3</sup> Broadband Survey, Consumer Reports, July 2021

Percentages of customers receiving different kinds of service can change. Our pricing information includes all the service providers that have been discovered with services to 1% or more residents

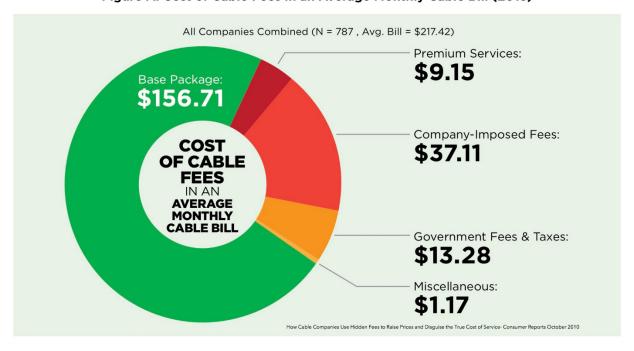


Figure A: Cost of Cable Fees in an Average Monthly Cable Bill (2018)

living in zip codes with at least 5% or more of their population in Craig County.

According to a 2019 Consumer Reports study<sup>4</sup>, the national average advertised price for standard triple play services of Internet, television, and telephone across the country is \$156.17. Because of fees and taxes, the actual national average bill is \$217.42. Nationally, consumers get an average of 24% added to their bill. Data caps which were turned off early in the pandemic are back<sup>5</sup> and will increase prices for heavy users. Hidden fees are spreading across many broadband services.

It has become normal to find a statement such as this in fine print terms and conditions, "Equipment, installation, taxes and fees, including regulatory recovery fees, Broadcast TV Fee (up to \$19.45/mo.), Regional Sports Fee (up to \$14.45/mo.) and other applicable charges extra, and subject to change during and after the term agreement." The Broadcast TV Fee was \$14.95 a year ago. The Regional Sports Fee was \$8.75 per month at the same time.

"Nearly half (47 percent) of U.S. TV viewers state they do not subscribe to "traditional cable," and among those that do, 44 percent are planning to drop cable or cut back services over the next year."

<sup>&</sup>lt;sup>4</sup> Cord Cutting Continues, Fueled By High Cable Pricing, Consumer Reports' Survey Finds 9/17/2019

<sup>&</sup>lt;sup>5</sup> Consumer Reports -Get Ready for Cable TV and Internet Price Hikes and Data Caps in the New Year 12/21/20

<sup>&</sup>lt;sup>6</sup> Xfinity terms and conditions- Craig County, VA, 9/15/21

The table below illustrates the estimated telecom expenditures, public and private, over the next thirty years. Over that time period, **nearly \$167M** will be spent on telecom services. This shows that there is money for broadband, but most of it is placed in envelopes every month and much of it leaves both the county and the state. Redirecting as little as 5% of those funds could build fiber to every home and business in Craig County.

Telecom Expenditures - Craig County, VA

Total Households		2,29	7				
Businesses		66					
Estimated Internet Access Type	Households using Cell Phone for Internet	Households with "little" broadband DSL	Households with Cable Modems	Households with no Internet			
Household Percentage	9%	42%	32%	17%			
Number of households	207	965	735	390			
Average monthly telecom expenditures	Cell Phone for Voice/Internet \$90 Cable/satellite TV: \$65 bundle	Cell Phone \$70 Phone: \$13 Satellite TV: \$60 Broadband Internet: \$45	Cell Phone \$70 Phone \$15 TV \$43 Broadband Internet \$45	Cell Phone, no Internet, \$70 Cable/satellite TV: \$65			
Monthly Cost of Services	\$155	\$188	\$173	\$135			
Annual household cost	\$1,860	\$2,256	\$2,076	\$1,620			
Annual cost all households	\$384,518	\$2,176,453	\$1,525,943	\$632,594			
30 year expenditure	\$11,535,534	\$65,293,603	\$45,778,291	\$18,977,814			
Total residential expenditures		\$141,58	5,242				
Total Estimated Cost of Hidden Fees	\$20,872,618						
Total Business Costs	\$4,098,600						
Total expenditures		\$166,55	66,461				

# 4.1 LOCAL PRICING DATA

This information provides pricing data and services available from providers in Craig County. Prices, availability and promotional offers change frequently and sometimes vary depending on street address. Information was compiled using a variety of public sources and Internet Service Provider (ISP) websites including Decision Data which combines FCC data and data they collect from social media and Broadband Now. Exact availability requires customer names and specific street addresses. Internet Service Providers showing less than 1% coverage or ones that cannot be verified are not shown in the following data.

## Summary of Service Provider Data - Craig County, VA

	Least Expensive Internet Only Service	Least Expensive Internet Only Service Meeting 25/3	Least Expensive Triple Pay Package Meeting
Citizen's Telephone DSL	\$55.05	N/A	N/A
Pemtel DSL	\$56.95	\$99.95	N/A
TDS Telecom DSL	\$67.95	N/A	N/A
Verizon DSL	\$74.99	No verified service in the county	
Citizen's Telephone	\$39.95	\$79.95	\$158.05
Suddenlink Cable	Estimated Regular Cost \$60	Estimated Regular Coast \$90	
Xfinity Cable	\$45	\$45	\$130.99
Fiber	No Residential Fiber		
All Points Wireless	\$59.95	\$99.95	N/A
Gigabean Wireless	\$45	\$65	N/A
HughesNet	\$59.99	\$59.99	N/A
Viasat	\$84.99	\$119.99	N/A
Starlink	\$99	\$99	N/A

All the information available at the time of the report is included in this table. If a table cell has no information, that information was not found. However, if there is no information in the "One-time Fees," it does not necessarily mean there are no one-time fees. It just means that information on the one-time fees could not be found on the company's public website.

NOTE: Many ISPs do not provide upload speeds. This table indicates that no upload speed was discoverable by the abbreviation 'NA' (Not Available).

#### Wireline Internet service provider comparison for Carroll County, VA

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/Month)	One- Time Fees	Services & Incentives
Citizen's Telephone Cooperative	\$55.05			1.5/NA	None		Internet Only
Citizen's Telephone Cooperative	\$75.05			3.0/NA	None		Internet Only
Citizen's Telephone Cooperative	\$95.05			6.0/NA	None		Internet Only
PemTel DSL	\$56.95		Local Telephone \$18	6/1			Internet Only
PemTel DSL	\$59.95		Local Telephone \$18	8/1			Internet Only
PemTel DSL	\$62.95		Local Telephone \$18	10/1			Internet Only
PemTel DSL	\$68.95		Local Telephone \$18	14/1			Internet Only
PemTel DSL	\$74.95		Local Telephone \$18	15/1			Internet Only
PemTel VDSL	\$99.95		Local Telephone \$18	25/3			Internet Only

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/Month)	One- Time Fees	Services & Incentives
TDS Telecom DSL	\$67.95	\$29.95 Two years	\$10 Modem required	36/1.5		\$49.9 95 Install ation Fee	Installation Fee Waived
TDS Telecom DSL	\$175.93 Without modem	\$29.95 Internet TV \$59.99 Two years \$24.99 phone \$124.93 Total promo rate with modem	\$10 Modem required				Unlimited local calls & 30 minutes long distance each month, voicemail \$5 additional
Verizon DSL	\$74.99	Rate "may" increase after first year		1.1/NA		\$60 \$29.9 9 Activa tion fee waive d for online order	Includes Telephone- No Verizon DSL offers found in Zip 24070
Citizen's Telephone Cooperative Cable	\$39.95			10/NA	None		Internet Only Free modem & Installation
Citizen's Telephone Cooperative Cable	\$59.95			25/NA	None		Internet Only Free modem & Installation
Citizen's Telephone Cooperative Cable	\$79.95			50/NA	None		Internet Only Free modem & Installation
Citizen's Telephone Cooperative Cable	\$158.05			50/NA	None		Internet, TV- 23 Channels, and Phone with unlimited Local & Long Distance

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/Month)	One- Time Fees	Services & Incentives			
Citizen's Telephone Cooperative Cable	\$198.05			50/NA	None		Internet, TV- 65 Channels (Analog), and Phone with unlimited Local &			
Citizen's Telephone Cooperative Cable	\$208.05			50/NA	None		Internet, TV- 180 Channels, and Phone with unlimited Local & Long Distance			
Citizen's Telephone Cooperative Cable	\$218.05			50/NA	None		Internet, TV- 200 Channels, and Phone with unlimited Local & Long Distance			
	Spectrum is including \$50 Emergency Broadband benefit as their promo pricing with incom restrictions until money runs out									
SuddenLink	Unable to verify any Suddenlink locations									
Xfinity	\$45	30 days prepaid Internet "30 day Refills" \$62.50- promo buy two months get \$35 off		50/5		Requi res additi onal purch ase of a \$35 mode m				
Xfinity	\$99.95	One year contract \$29.99 for two years with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices \$5/mo. per device . XFi Gateway \$14, XFi or XFi Complete \$25 monthly includes unlimited data	200/NA	1.2 TB Starting 2022 50 GB will be added \$10 each 50 GB plus tax. Charges will not exceed \$100 each month or unlimited for \$30/mo		Internet Only \$10 discount for enrolling in paperless and automatic billing			

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/Month)	One- Time Fees	Services & Incentives
Xfinity	\$100.95	One year contract \$59.99 for two years with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices \$5/mo. per device . XFi Gateway \$14, XFi or XFi Complete \$25 monthly includes unlimited data	400/NA	1.2 TB Starting 2022 50 GB will be added \$10 each 50 GB plus tax. Charges will not exceed \$100 each month or unlimited for \$30/mo		Internet Only \$10 discount for enrolling in paperless and automatic billing \$100 Visa® Prepaid Card Free Getting Started Kit and shipping Option to add Flex 4K streaming TV box + Voice Remote at no extra cost. Includes Peacock Premium.
Xfinity	\$110.95	One year contract \$79.99 for two years with paperless & auto pay \$89.99 for year three	Limited to 3 devices. 1 device included, additional devices \$5/mo. per device . XFi Gateway \$14, XFi or XFi Complete \$25 monthly includes unlimited data	1200/NA	1.2 TB Starting 2022 50 GB will be added \$10 each 50 GB plus tax. Charges will not exceed \$100 each month or unlimited for \$30/mo		Internet Only \$10 discount for enrolling in paperless and automatic billing \$150 Visa® Prepaid Card Free Getting Started Kit and shipping Option to add Flex 4K streaming TV box + Voice Remote at no extra cost. Includes Peacock Premium.

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/Month)	One- Time Fees	Services & Incentives
Xfinity	\$130.99	One year contract \$89.99 for two years with paperless & auto	Limited to 3 devices. 1 device included, additional devices \$5/mo. per device . XFi Gateway \$14, XFi or XFi Complete \$25 monthly includes unlimited data	200/NA	1.2 TB Starting 2022 50 GB will be added \$10 each 50 GB plus tax. Charges will not exceed \$100 each month or unlimited for \$30/mo		Internet , Basic TV 130+ Channels, and Xfinity Voice \$10 Auto-pay discount
Xfinity	\$159.99	\$99.99/ mo for the first 24 mos with 2-Year Agreemen t Includes \$10/mo automatic payments and paperless billing discount for 24 months	Limited to 3 devices. 1 device included, additional devices \$5/mo. per device . XFi Gateway \$14, XFi or XFi Complete \$25 monthly includes unlimited data	800/NA	1.2 TB Starting 2022 1.2 TB 50 GB will be added \$10 each 50 GB plus tax. Charges will not exceed \$100 each month or unlimited for \$30/mo		Internet , 205+ Channels, and Xfinity Voice \$10 Auto-pay discount \$100 Visa® Prepaid Card Free Getting Started Kit and shipping 150 Hours of DVR Service

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/Month)	One- Time Fees	Services & Incentives			
Xfinity	\$189.99	\$129.99/ mo for the first 24 mos with 2-Year Agreemen t Includes \$10/mo automatic payments and paperless billing discount for 24 months	Limited to 3 devices. 1 device included, additional devices \$5/mo. per device . XFi Gateway \$14, XFi or XFi Complete \$25 monthly includes unlimited data	1200/NA	Unlimited		Internet , Extra TV 125+ Channels, and Xfinity Voice \$10 Auto-pay discount \$150 Visa® Prepaid Card Free Getting Started Kit and shipping NETFLIX, EPIX 300 Hours of DVR Service			
Xfinity	\$199.99	\$149.99/ mo for the first 24 months with 2-Year Agreemen t Includes \$10/mo automatic payments and paperless billing discount for 24 months	Limited to 3 devices. 1 device included, additional devices \$5/mo. per device . XFi Gateway \$14, XFi or XFi Complete \$25 monthly includes unlimited data	1200/NA	Unlimited		Internet , Extra TV 245+ Channels, and Xfinity Voice \$10 Auto-pay discount \$150 Visa® Prepaid Card Free Getting Started Kit and shipping NETFLIX, EPIX 300 Hours of DVR Service			
	All Xfinity TV Plans include this statement: "Broadcast TV Fee (up to \$19.45/mo.), Regional Sports Fee (up to \$14.45/mo.) and other applicable charges extra, and subject to change during and after the term agreement."									

# Wireless Internet service provider comparison for Craig County, VA

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Incentives & Notes
All Points Broadband Wireless	\$59.95	1 year contract		10/2		\$100 installation and provisioning fee	
All Points Broadband Wireless	\$89.95	1 year contract		15/3		\$100 installation and provisioning fee	
All Points Broadband Wireless	\$99.95	1 year contract		25/3		\$100 installation and provisioning fee	
Gigabeam Networks	\$45	1 year contract		10/1	Unlimited	\$49 with 1 year contract \$99 with month to monty	WiFi Router Included
Gigabeam Networks	\$65	1 year contract		25/3	Unlimited	\$49 with 1 year contract \$99 with month to monty	WiFi Router Included
Gigabeam Networks	\$85	1 year contract		25/3	Unlimited	\$49 with 1 year contract \$99 with month to monty	WiFi Router Included

# Satellite Internet service provider comparison for Craig County, VA

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Downloa d/Upload Speed (Mbps)	Data Cap (GB/Month)	One-Time Fees
HughesNet	HughesNet \$59.99		\$14.99 equipment lease it you don't purchase	25/3	After 10 GB (speeds drop to 1-3 Mbps)	Purchase pricing is \$249.99 to purchase or \$99 lease activation- instant lease savings of \$99- limited time
		\$400 ETF				\$100 instant savings if equipment Is
HughesNet	\$69.99	\$49.99 for first six months. 24 month commitment required. Up to	\$14.99 equipment lease it you don't purchase	25/3	After 20 GB (speeds drop to 1-3 Mbps)	Purchase pricing is \$249.99 to purchase or \$99 lease activation- instant lease savings of \$99- limited time
		\$400 ETF	paranasa			\$100 instant savings if equipment Is
HughesNet	\$99.99	\$79.99 for first six months. 24 month commitment required. Up to \$400 ETF	\$14.99 equipment lease it you don't purchase	25/3	After 30 GB (speeds drop to 1-3 Mbps)	Purchase pricing is \$249.99 to purchase or \$99 lease activation- instant lease savings of \$99- limited time \$ \$100 instant savings if equipment Is
HughesNet	\$149.99	\$129.99 for first six months. 24 month commitment required. Up to \$400 ETF	\$14.99 equipment lease it you don't purchase	25/3	After 50 GB (speeds drop to 1-3 Mbps)	Purchase pricing is \$249.99 to purchase or \$99 lease activation- instant lease savings of \$99- limited time \$100 instant savings if equipment Is
Viasat	\$84.99	\$64.99 for first three months 24 month contract	\$12.99/ month (modem)	12/3	40 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease \$299.99-Setup Fee- Unknown
Viasat	\$119.99	\$84.99 for first three months 24 month contract	\$12.99/ month (modem)	25/3	60 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease \$299.99-Setup Fee- Unknown

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Downloa d/Upload Speed (Mbps)	Data Cap (GB/Month)	One-Time Fees
Viasat	\$169.99	\$119.99 for first three months 24 month contract	\$12.99/ month (modem)	30/3	100 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease \$299.99-Setup Fee- Unknown
Viasat	\$249.99	\$169.99 for first three months 24 month contract	\$12.99/ month (modem)	30/3	150 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease \$299.99-Setup Fee- Unknown
Starlink	\$99	Craig County targeted for service in mid to late 2021	Unknown but has \$50 shipping cost and \$29.10 estimated tax for	100/40	None	

<sup>\*</sup> Starlink service has just gone from beta to standard service but availability is still by address only so Starlink may not be available in all areas. Early reports from beta testers have been generally positive. Reported speed test results vary, but many users are reporting 10 to 50 Megabit download speeds and upload speeds of 5 to 20 Megabits. Some users have seen higher speed test results. Latency is much lower than traditional geostationary satellite services like HughesNet and Viasat, but latency is still much higher than terrestrial fiber Internet connections. If pricing remains similar to what is being charged for early users, Starlink could be a very significant improvement for rural residents and businesses. It is targeted for the Craig County area in mid to late 2021.

# 5 CRAIG RESIDENTIAL SURVEY RESULTS

During the fall of 2021, a broadband survey was conducted in Craig County as part of a county wide study in broadband needs. The online (Web) version of the survey was publicized on social media, the County Web site, and a Postal Service mailing to all households. Residents were encouraged to complete the survey online or fill out and return the paper version by surface mail. Businesses were encouraged to complete a separate business-focused survey, and the results of that are included later in this report.

A total of 266 responses were collected in the residential survey–roughly 11.6% of all households in Craig County responded to the survey. Not all responders answered every question. Note that because of rounding, not all percentages sum exactly to 100%. Many comments were received and are included in the appendices.

Some of the key findings from the results are listed below.

93% of respondents are interested in faster and more reliable Internet service

60% of residents are "dissatisfied" or "very dissatisfied" with current Internet speeds

93% of respondents said that they believe the County government should help facilitate better broadband

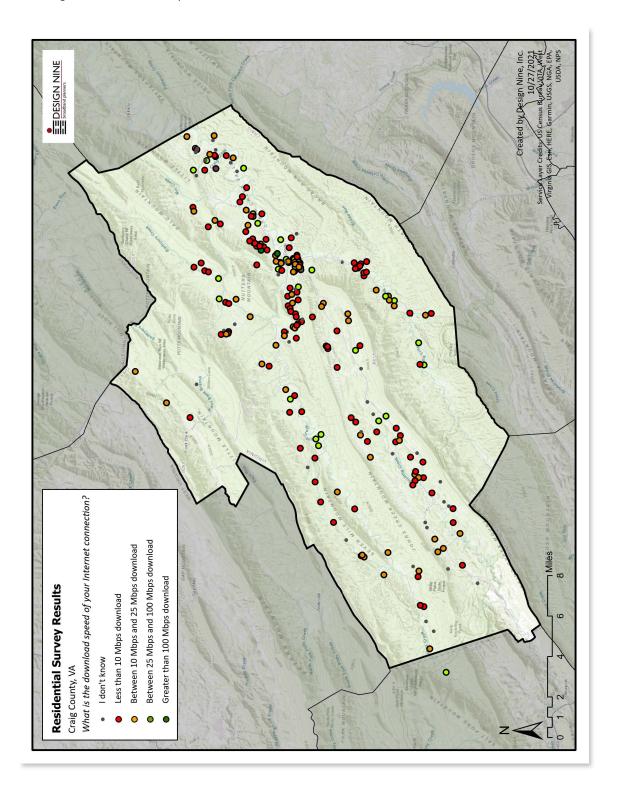
28% of residents have 9 or more Internet-connected devices in their home

72% of respondents report they have trouble using common Internet services

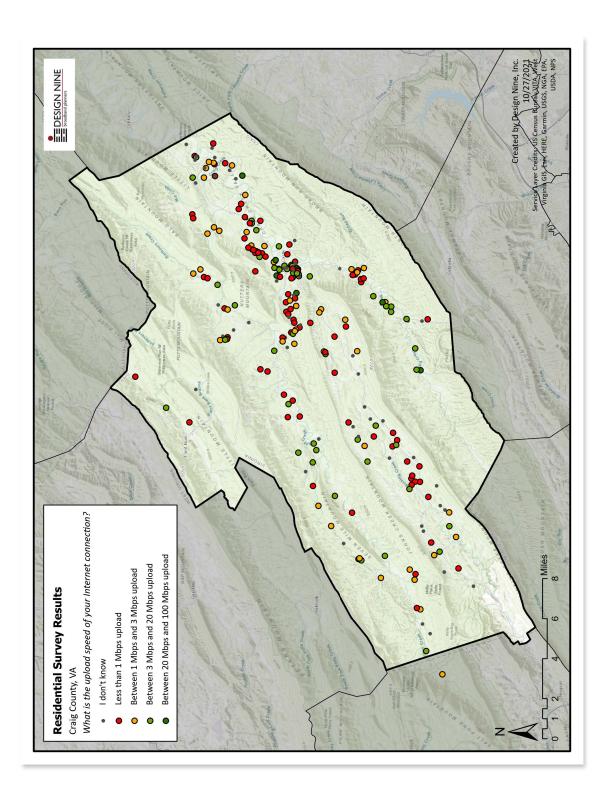
34% indicate that availability of broadband Internet is affecting where they choose to live

# 5.1 DISTRIBUTION OF RESIDENTIAL SURVEY RESPONSES

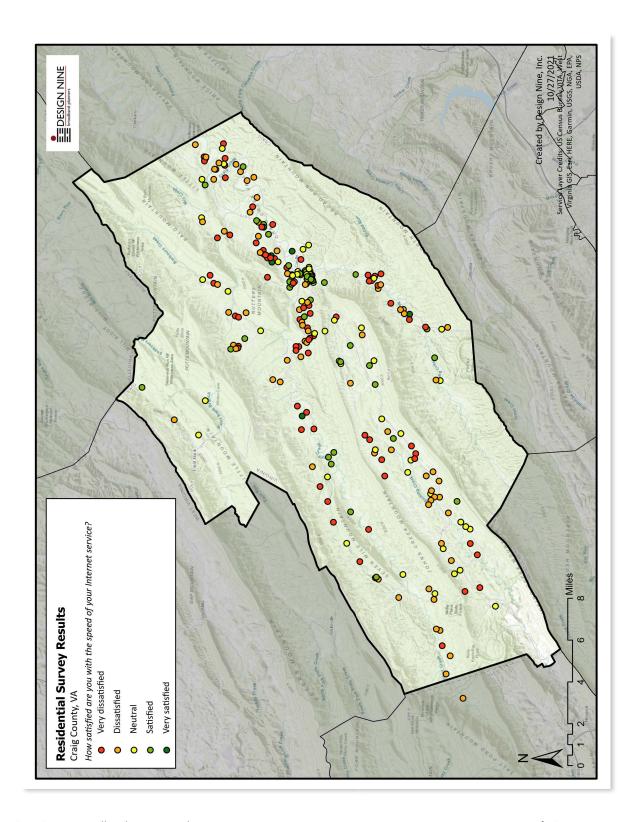
The map below shows the geographic distribution of responses to the residential survey, coded according to the *download speed* of their Internet connection (Question 9).



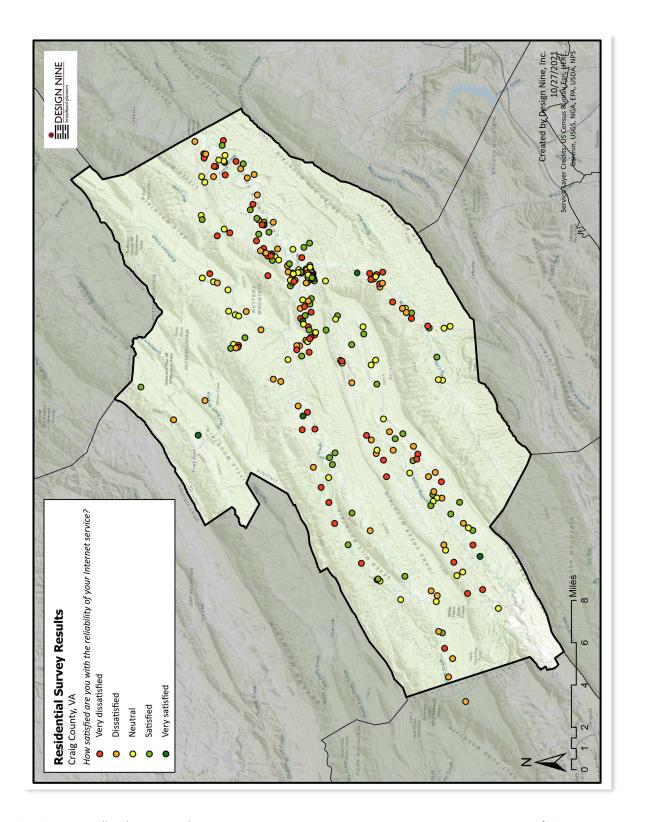
The map below shows the geographic distribution of responses to the residential survey, coded according to the *upload speed* of their Internet connection (Question 10).



The map below shows the geographic distribution of responses to the residential survey, coded according to their satisfaction with the *speed* of their existing Internet service (Question 12).



The map below shows the geographic distribution of responses to the residential survey, coded according to their satisfaction with the *reliability* of their existing Internet service (Question 13).



# 5.2 RESIDENTIAL SURVEY SUMMARY DATA

#### 1. Select the items you agree with below

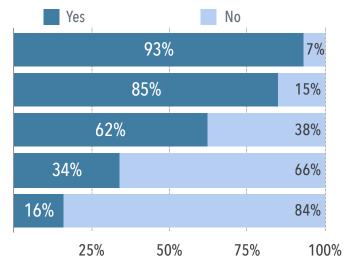
I need better Internet/data service.

I need better cellular telephone service.

I need better Internet for Covid-19 work from home

I need better landline telephone service.

I am satisfied with all of my services.



#### 2a. Total number of adults in household

None	1	2	3	4	5	6	7+
0	29	177	36	12	4	2	2
0%	11%	68%	14%	5%	2%	1%	1%

#### 2b. Total number of K-12 Students in the house hold

None	1	2	3	4	5	6	7+
148	44	28	6	2	0	0	0
65%	19%	12%	3%	1%	0%	0%	0%

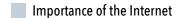
#### 2c. Total number of college students in household

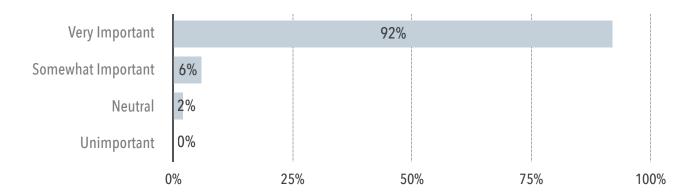
None	1	2	3	4	5	6	7+
186	26	3	3	0	0	1	1
85%	12%	1%	1%	0%	0%	0%	0%

## 2d. How many total Internet users in household

None	1	2	3	4	5	6	7+
32	15	110	48	37	14	6	2
12%	6%	42%	18%	14%	5%	2%	1%

## 3. How important is Internet access to you or your household?





4. How much do you spend each month for ALL telecom services? This would include any fees for services like phone, TV, and Internet. Do not include cellphones.

\$50 or less	\$50 to \$75	\$75 to \$100	\$100 to \$150	\$150 to \$200	More than \$200/month
11	20	39	61	51	78
4%	8%	15%	23%	20%	30%

#### 5. How much do you pay just for Internet access each month?

No Internet	I only use free hotspots	\$10 to \$20	\$21 to \$40	\$41 to \$60	\$61 to \$80	More than \$80/ month	l don't know
7	4	1	12	66	65	89	14
3%	2%	0%	5%	26%	25%	34%	5%

#### 6. What type of Internet do you have at home?

DSL line	126	48%
Cellular wireless	41	16%
Cable modem	27	10%
I don't know	24	9%
Satellite	14	5%
Wireless ISP	11	4%
No Internet	8	3%
Other	6	2%
Fiber	3	1%
Dial-up	3	1%

#### Other internet types responses:

I have both DSL through TDS phone lines and also satellite through Hughes Net.

Use my cell

US cellular router

We use our cellular devices and hot spots for internet, tv, etc.

At our home in Falls Church its fiber...we are still trying to get decent internet at the New Castle address. We are still working on it, but cannot find anything better than unreliable DSL service...exploring satellite or some other solution but not found yet.

We had satellite Internet for two months and had to cancel because it absolutely did not work at our home

DSL AND satellite

Only internet available is from our cell phone provider who caps data usage and speed No other option but what TDS provides

Whatever TDS is.

Via TDS phone

fiber, with copper wire from pole to house

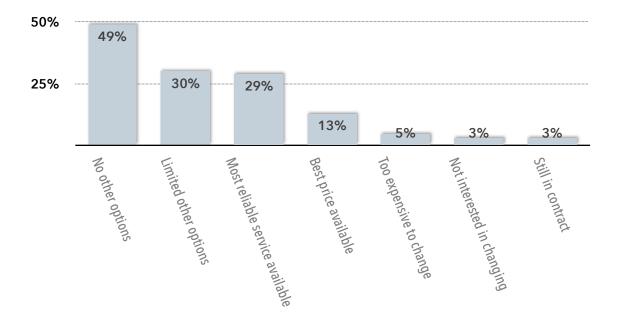
I don't know but TDS provides sub par quality

The fact that this survey is even needed is concerning, this is 2021 ... Of course Craig county needs better internet , so we can work and learn.

I have both DSL through TDS and satellite through Hughs Net.

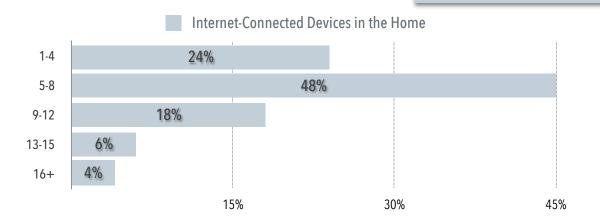
# 7. Based on the type of Internet connection you selected above, why do you still have it? (select all that apply)

49% of respondents indicated they have no alternative to their current Internet provider



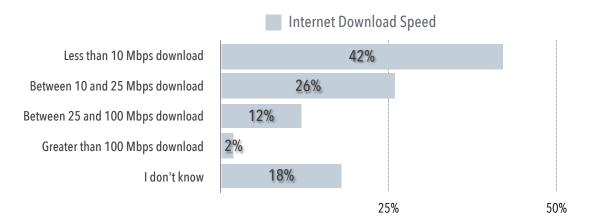
# 8. How many devices (for example computers, cellphones, smart TVs) connect to the Internet in your household?

28% of residents have 9 or more Internet-connected devices



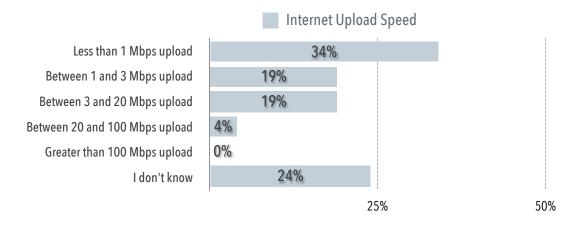
#### 9. What is the download speed of your Internet Connection?

Only 32% of residents can confirm that they have Internet download speeds that meets the FCC definition of adequate broadband service (25 Meg down). It is not unusual that many respondents do not know their exact Internet speeds.



#### 10. What is the upload speed of your Internet Connection?

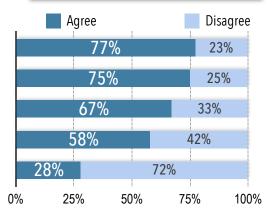
Only 23% of residents have Internet upload speeds that meets the FCC definition of adequate broadband service (3 Meg up). It is not unusual that many respondents do not know their exact Internet speeds.



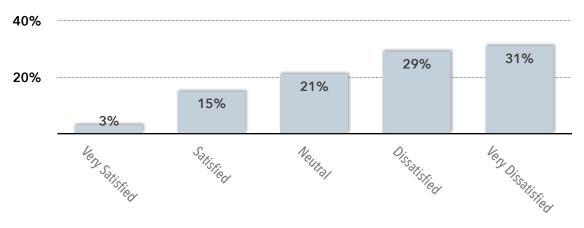
#### 11. Select the items you agree with below

I have trouble using the Internet when others are using it
I have trouble viewing online videos/lectures/ movies/tv shows
I have trouble using Facetime, Skype or other video chats
I have trouble loading pictures to my social media account(s)
I do not have trouble performing any of these activities

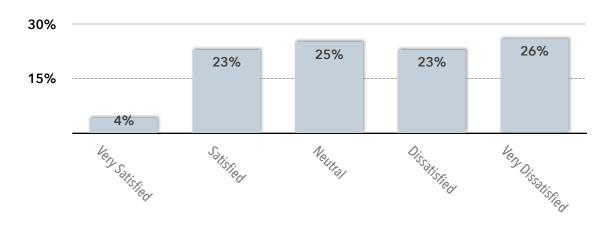
More than 70% of respondents report they have trouble using common Internet services



# 12. How satisfied are you with the speed of your internet service?



# 13. How satisfied are you with the reliability of your internet service?



## 14. Select all items you use the Internet for now

Streaming video and TV services (Netflix, Hulu, Disney, etc.)	206	77%
Online Backup (files, photos, music)	165	62%
Learn about Covid-19 pandemic issues and information	139	52%
Homework/Schoolwork/Distance learning	133	50%
Work from home during Covid-19 pandemic	128	48%
VoIP Internet phone (Vonage, Skype, FaceTime, etc.)	124	47%
Telemedicine or tele-health	124	47%
Online gaming	87	33%
Smart speakers (Alexa, Homepod, Google Assistant, etc.)	83	31%
Home security (cameras, video doorbells, etc.)	83	31%
Other	38	14%

#### Other internet types responses:

Communication tool, religious services

Currently I only have Dish for TV and Us cellular for phone. No internet currently. Would like something to run up my end of the county that affordable and reliable.

Don't need or want

email

email, banking, searches

E-mail, manage accounts, online shopping, research topics important to managing the farm

Email, research, shopping

Email, Zoom meetings

Facebook, etc.

Family members work from home full time.

Full time work from home

General information

I use it for email, Facebook, messaging, and to pay bills.

I work from home all of the time regardless of pandemic.

"I work from home but it is not related to covid 19, I have worked from home for 5 years and have to use a VPN when doing so

we also homeschool."

internet access

Meetings. Instruction. Communication.

My son's embrace seizure watch

News

News, Google searches, online shopping, online banking

Online banking

Online banking & purchasing

Online banking

Research

YouTube

Teaching grandkids piano

Internet shopping"

Order needed items, Facebook, Google info.

Ordering items

Research

Research

Research, online shopping, etc.

self employed business

Small home business depends on internet for every interaction/order

Solar panel system

TDS provides low quality in a aspects.

TV and movies

We are academics and published authors who do a significant amount of research online for our writing projects.

Weather station

Webex, outlook conferencing.

Work from home

Work from home even when not in a pandemic - flexible work options.

Work from home regardless of Covid

Work in general. Doesn't have to be COVID related.

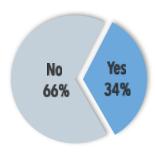
Work programs and zoom meetings

Zoom - professional meetings, church meetings

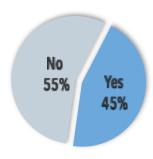
Writing grant proposals for community development

#### 15. High speed, affordable Internet influences where I choose to live?

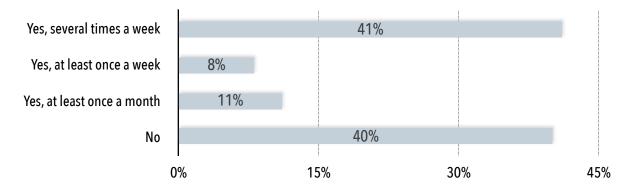
Availability of broadband Internet is affecting where people choose to live. The response of 34% is typical of many communities. Internet availability can impact home prices and community development.



#### 16. Has the Covid-19 crisis had a negative economic impact on your household?



# 17. Does anyone in your household use / need the Internet to complete school assignments, participate in distance learning, or receive job training course work?



# 18. Who is your Internet Service provider?

Some responses included more than one provider.

TDS Telecom	158	61%
US Cellular	33	13%
Citizen's Telephone Cooperative	19	7%
PemTel	16	6%
Other	16	6%
T-Mobile	10	4%
Satellite Internet	7	3%
Shentel	1	0%

# 19. Do you have data limits (caps) on your current Internet service?



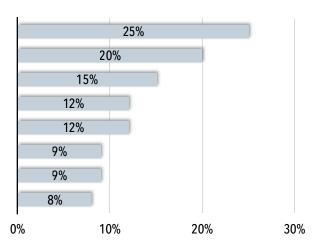
# 20. If you have data caps, have you exceeded those caps?

Yes	16%
No	14%
I do not have data caps	29%
I don't know	42%

#### 21. Do you work from home?

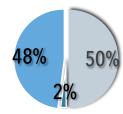
49% report working from home part or full time—the Internet has made residential neighborhoods into business districts. Home-based jobs and businesses can help reduce road maintenance. This is also a high number relative to past surveys we have conducted, and undoubtedly the Covid crisis has caused this number to rise.

I am retired and do not work from home
I work full time at home for my employer.
I need nights and weekends access for my job.
I never work from home.
I work part time at home for my employer.
I would if I had better Internet at home
I am self employed and work full time from home.
I am self employed and work part time from home.

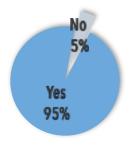


#### 22. Are you Interested in Gigabit fiber Internet Service?





# 23. Should your county government help facilitate better and more affordable broadband services?



#### 24. Any Other Comments

Many comments were received. Because of the volume of replies, these comments can be found in Appendix B.

# 6 CRAIG BUSINESS SURVEY RESULTS

A separate and unique business survey was run concurrently with the residential survey. Only six responses were collected from Craig County Businesses. The small number of responses invalidates the need for a detailed breakdown like that which the residential responses received. A few of the key findings from the businesses who did participate are listed below.

5 out of 6 business respondents need better internet service

6 out of 6
respondents say that
County government
should facilitate better
broadband

3 out of 6 business respondents are home-based businesses

2 out of 6 business pay more than \$150/ month for their internet

4 out of 6 business respondents say they are on DSL service, 2 of 6 on cable 2 out of 6 business respondents have upload speeds below 1 Mbps Half of the respondents say that they have no other options for internet service

2 out of 6 business say that access to good internet is a factor in choosing to stay in or leave The County

3 out of 6 business are "Dissatisfied" with their current internet speeds 3 out of 6 business are "Dissatisfied" with their current internet reliability 4 of the businesses have TDS and 2 of them are on Citizen's Telephone Co-op 4 out of 6 business respondents say they are interested in fiber internet

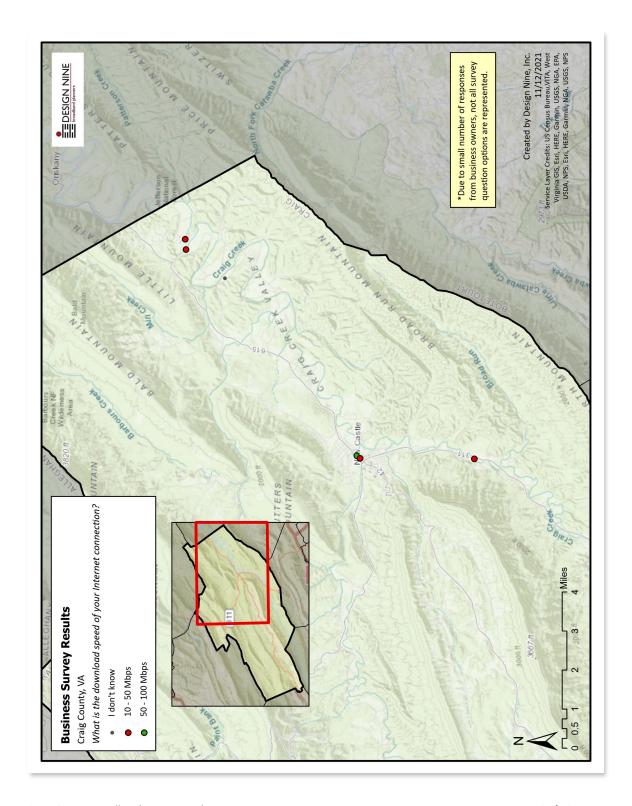
Despite the small number of responses, there is some consensus about the substandard state of business class broadband available In Craig County. Half of the businesses said they were disappointed in the speed and/or reliability of their current service. All of the respondents stated that they either had no other options for service or were already on the most reliable service

There is also agreement on the importance of the internet to the success of their businesses and all six respondents indicated that they think the Craig County government should be involved in improving the internet services in the County.

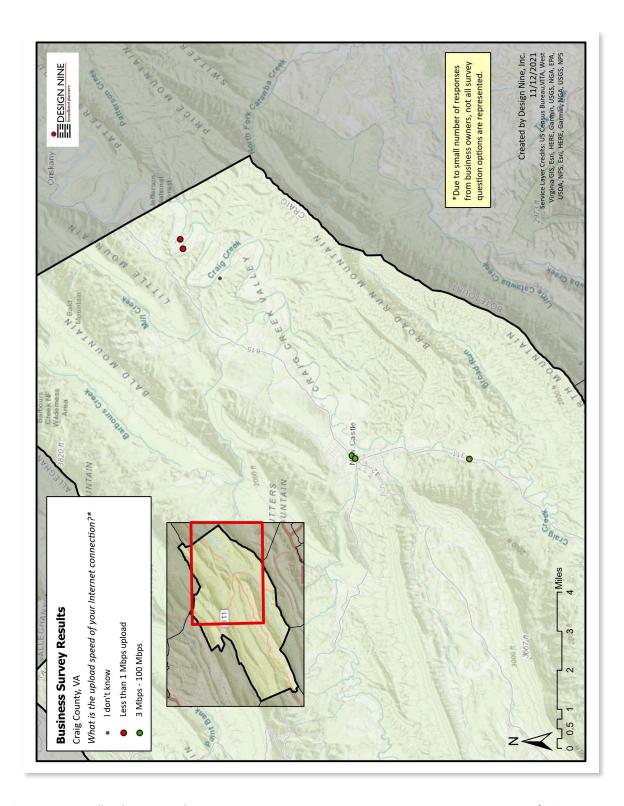
Half of the Business respondents reported being home based which further highlights the need to bring better and more affordable internet service to Craig county. TDS and Citizen's are the only providers represented in the six responses that we received.

# 6.1 DISTRIBUTION OF BUSINESS SURVEY RESPONSES

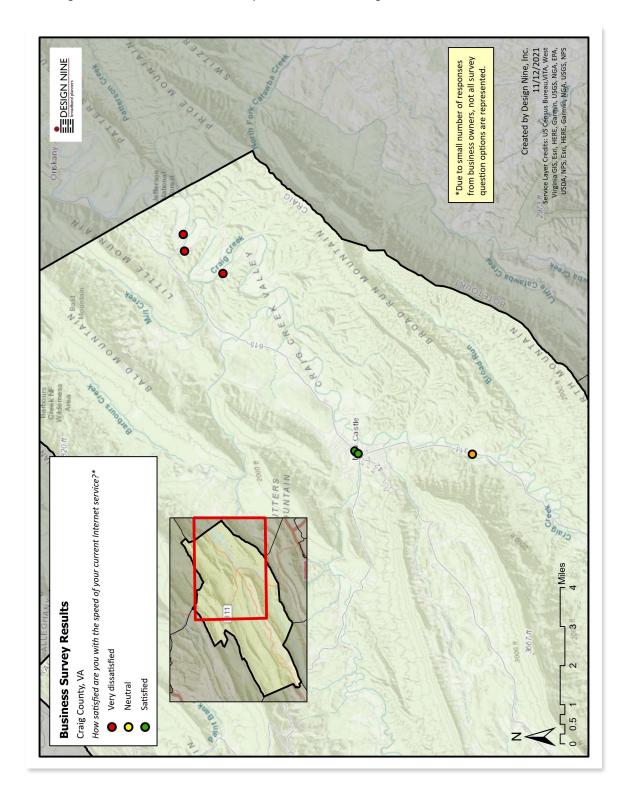
The map below shows the geographic distribution of responses to the business survey, coded according to the *download* speed of their Internet connection (Question 10).



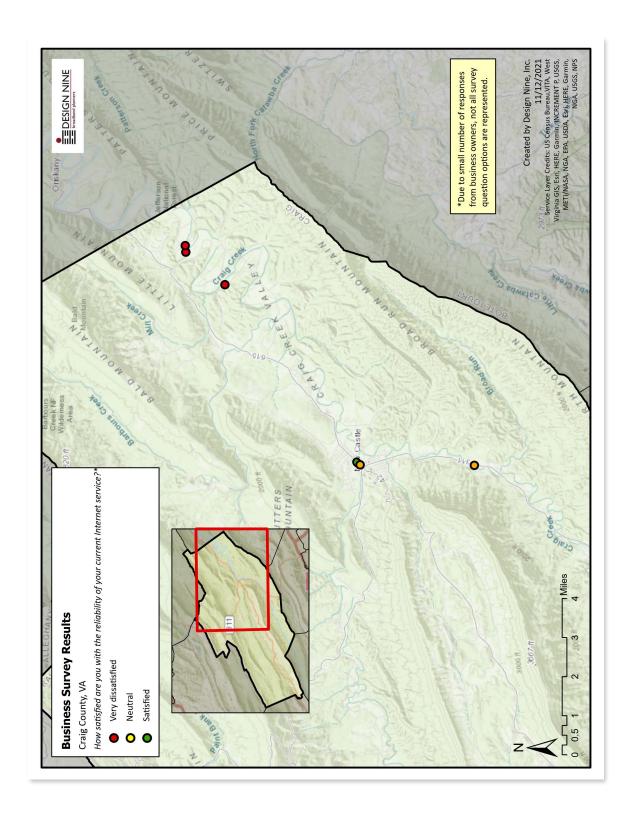
The map below shows the geographic distribution of responses to the business survey, coded according to the *upload* speed of their Internet connection (Question 11).



The map below shows the geographic distribution of responses to the Business survey, coded according to their satisfaction with the *speed* of their existing Internet service (Question 12).



The map below shows the geographic distribution of responses to the Business survey, coded according to their satisfaction with the *reliability* of their existing Internet service (Question 13).



# 7 CURRENT AND FUTURE DEMAND ANALYSIS

#### 7.1 HOW MUCH BROADBAND IS ENOUGH?

Bandwidth needs for the past several years have been growing by an estimated 30% per year and show no sign of slowing.

This means residential and business bandwidth needs are doubling every three years.

As computers and associated hardware (e.g. video cameras, audio equipment, and VoIP phones) become more powerful and less expensive, new applications and services are continually emerging that drive demand for more bandwidth.

"Next generation" is the term used to describe future planning for network connectivity and infrastructure. Next-generation broadband reaps substantial benefits. There are several key benefits of Next-generation broadband:

- Dramatically faster file transfer speeds for both uploads and downloads.
- The ability to transmit streaming video, transforming the Internet into a more visual medium.
- The means to engage in true-real time collaboration.
- The ability to use many applications simultaneously.
- The ability to maintain flexible work schedules by being able to work from home on a parttime or full-time basis.
- The ability to obtain health-related services for an occasional illness and/or long term medical services for chronic illnesses.

Clearly, consumers have a strong interest in a visual medium from when and wherever they are. YouTube is the second most popular search engine after Google, which demonstrates the need to support the infrastructure to transmit streaming video. In addition to video streaming, true real-time collaboration also provides an effective way for people to interact from wherever they are. People can engage in a two-way real-time collaboration so that fruitful, visual conversations can be held between friends, family, business associates from the state, country, or internationally.

Because of fiber networks, employees have the capability of working from home. Findings suggest that if all Americans had fiber to the home, this would lead to a 5% reduction in gasoline use, a 4% reduction in carbon dioxide emissions, \$5 billion in lower road expenditures, and 1.5 billion commute hours recaptured.

In Craig County today, many residents and businesses are still relying on copper-based services. The bandwidth tables on the following pages show what is likely to be needed over the the next several years in terms of bandwidth. The existing copper infrastructure is going to become a limiting factor in economic development.

# 7.2 JOB AND WORKFORCE CHALLENGES

There are many areas and communities in Craig County that can be attractive to an emerging new group of businesspeople and entrepreneurs that typically are well-educated, own their own

businesses or work for large global corporations, and are making choices about where they lived based on family needs and interests rather than business interests.

This new breed of entrepreneurs and workers places a high value on the kinds of amenities that contribute to a good quality of life, such as traditional neighborhoods, vibrant downtown areas, a wide range of cultural and recreation opportunities, good schools, and a sense of place.

These businesspeople and their families make relocation decisions based on quality of life only where there is abundant and affordable broadband, because broadband enables this new approach to personal and work life. Most residents and businesses in Craig County currently have, at best, Internet service that meets the FCC definition of "fully served," which is 25 Megabits down/3 Megabits up bandwidth. Some more recent grant programs are finally pushing higher speeds, with 100 Mbps down, 20 Mbps up as a more realistic target.

However, what has become painfully clear during the Covid pandemic is that this definition of "fully served" is not adequate to support many kinds of work from home activities. During the Covid lockdown, it was common to have both spouses trying to work from home while K12 and/or college age children were also trying to use video-heavy distance learning resources.

When home-based workers need to connect to a corporate VPN (Virtual Private Network), bandwidth requirements can increase even more. Work from home and business from home activities should have, at a minimum, a symmetric service of at least 10 Megabits download and 10 Megabits upload speeds. Higher speed service could include service levels like 25 Megabits down/10 Megabits up. The critical requirement is an upload speed that supports work from home.

If the goal is to enhance business access to broadband, there can be no upper limit on the definition of broadband. Saying that broadband (as an example) is 5 Megabits/second of bandwidth or 10 Megabits/second is to tell the residents and businesses in the county that there will be limits on their work and job opportunities.

Broadband is a community and economic development issue, not a technology issue. The essential question is not, "What system should we buy?" or "Is 5G wireless better or cheaper than fiber?" Instead, the question is:

# "What do businesses of and home-based workers of Craig County need to be able to compete globally over the next thirty years?"

In short, Craig County today has "little broadband" in the form of DSL limited cable modem service, along with a very limited amount of "big broadband" in the form of fiber to some businesses and residents. If the county makes investments in broadband and telecommunications infrastructure, it is absolutely critical that those investments are able to scale gracefully to meet business and economic development needs for decades. To close that gap between the FCC definitions and what the county needs to support future work opportunities and to support K12 and higher education school work, the county needs the following:

#### Broadband Services, Technologies, and Needs

BROADBAND SERVICE	TARGET DATE	TECHNOLOGY	WHERE NEEDED
25 Mbps download 3 Mbps upload	2022	Wireless	As much of the county as possible, given funding constraints
25 Mbps download 10 Mbps upload	2023	Wireless	In many locations in the county
1 Gbps download 1 Gbps upload	2023	Fiber	In some business and commercial areas
100 Mbps download 20 Mbps upload	2023	Fiber	In many locations in the county
100 Mbps download 100 Mbps upload	2024	Fiber	Available to a minimum of 50% of residents and businesses in the county

Two key concepts that should drive Craig County public/private partnerships and investments in telecom are:

#### "Broadband" is not the Internet

#### Bandwidth is not a fixed number

Broadband and "the Internet" are often used interchangeably, but this has led to much confusion. Broadband refers to a delivery system, while "the Internet" is just one of many services that can be carried on a broadband network. The challenge for the County is to ensure that businesses and homes have a broadband network with sufficient bandwidth to deliver all the services that will be needed and expected within the next three to four years, including but not limited to "the Internet."

The economic impact can include the following effects:

- Difficulty retaining some existing businesses. As business bandwidth needs continue to increase over the next several years, some businesses may need to move out of the area to ensure that they have the right bandwidth to support their business operations.
- Difficulty attracting new businesses. New businesses interested in some of the advantages of
  the county, like low cost of living, good recreational opportunities, and good workforce ethic,
  may be deterred by the cost and limited bandwidth available, and therefore choose other
  areas to locate.
- Difficulty keeping younger workers and families in the county. Younger workers and families
  tend to be heavy users of Internet services, and real-estate agents are reporting that younger
  house buyers are reluctant to live in areas with poor Internet service. Note that a significant
  percentage of respondents to the residential survey (34%) indicated that Internet
  availability or lack of it was affecting where they choose to live.
- Reductions in real estate value. Homes with poor Internet service are more difficult to sell, leading to lower prices, negatively impacting county income from property taxes.

# 7.3 BUSINESS BANDWIDTH NEEDS

The table below shows bandwidth consumption for several types of businesses and a projection of the bandwidth needed 5 and 10 years out. The Covid pandemic has had the effect of dramatically increasing the number of home-based works and has also affected business travel decisions. More and more businesses will invest in high definition (HD) quality business videoconference systems to reduce the need for travel and to maintain high quality communications with a dispersed workforce. These HD systems require substantial bandwidth; a two-way HD video conference requires 20-25 Mbps during the conference, and a three-way conference requires 30-35 Mbps during the conference.

**Business Bandwidth Needs** 

	LARGE BUSINESS		SMALL BUSINESS		HOME BASED WORKER	
DESCRIPTION	A larger business with about 50 workstations.		A small business with 10 to 15 employees, and 7-10 workstations.		One or two people working from home.	
	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps
Telephone	20	5	5	1.5	2	0.5
Credit Card Validation	4	4	1	1		0
Security System	1	5	1	2	2	2
Internet	50	500	7	10.5	2	20
VPN Connection	20	100	5	50	2	5
Data Backup	5	7.5	1	10	2	10
Web Hosting	1	2		0		0
Workforce Training (online classes)	5	20	1	10	2	10
HD Video- conferencing	20	125	2	20	2	10
Totals		768.5		105.0		57.5
5 YEARS FROM NOW	3-10 Gbps		250-500 Mbps		100-200 Mbps	
10 YEARS FROM NOW	10 + Gbps		2-4 Gbps		500-750 Mbps	

As more workers are moved to home-based offices, the business location must provide network access (Virtual Private Network (VPN)) to employees working from home. These home-based workers will make extensive use of videoconferencing to attend routine office meetings remotely and to enhance communications with co-workers, including videoconferences with other home-based workers in the company. A VPN network providing remote access to just two or three home-based employees could require 50 Mbps of bandwidth during normal work hours.

# 7.4 RESIDENTIAL BANDWIDTH NEEDS

The table below depicts the bandwidth needed for typical residential services which are available now or will be available in the near future. The Covid pandemic has illustrated the shortcomings of cable Internet services, in which the upload and download speeds are highly asymmetric.

For home-based workers, upload speeds need to be equal to or nearly equal to download speeds. Current cable Internet systems are not able to deliver symmetric or near symmetric service. Today's shared networks (cable and wireless in particular) rely on the "bursty" nature of traffic to provide services to end users. If all end users were consuming their advertised maximum bandwidth, today's cable and DSL networks would grind to a halt.

#### Residential Bandwidth Needs

	RESIDENTIAL DAYTIME		EARLY EVENING		EVENING & LATE NIGHT	
DESCRIPTION	Work from h distance lear home sch telemedicine, vide	rning and ooling, streaming	Increased Internet use as children arrive home from school and employees from work.		Peak television and Internet use. Multiple TV's are on, phone and computer being used.	
	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps
Telephone	1	0.25	1	0.25	1	0.25
Work From Home	1	10	1	10	1	10
HD TV	1	4	2	8	2	8
Security System	1	2	1	2	1	2
Internet	1	1.5	1	1.5	2	3
Online Gaming	0	0.25	1	5	2	10
VPN Connection	0	0	1	2	1	2
Data Backup		0	1	5	1	5
Telehealth	1	4	1	4	1	4
Distance Learning/ home schooling		0	1	10	1	10
Videoconferencing		0		0		0
Average needed bandwidth		15-25	25-35			20-35
Five years from now	Five years from now 50-75 Mbps		60-90 Mbps		50-100 Mbps	
Ten years from now	150-300	Mbps	200-350 Mbps		175-250 Mbps	

Existing cable modem network users are overwhelming the digital cable networks that were upgraded as little as three or four years ago, and the firms have had to artificially reduce the bandwidth available for certain kinds of high bandwidth services (e.g. peer to peer file sharing). Some cable providers have even run into capacity issues with the TV portion of their networks, and some consumers have observed that some HD TV channels have been so highly compressed that picture quality has been noticeably degraded.

### 7.5 CURRENT AND FUTURE USES AND SERVICES

When analyzing future service needs, it is important to take into account ALL services that may be delivered over a broadband connection. Broadband is not a service – it is a delivery medium. Using roads as an analogy, broadband is the road, not the trucks that use the road. Internet access is a service delivered by a broadband "road," and that Internet service is just one of many services that are in demand. Today, congestion on broadband networks is not due just to increased use of email and Web surfing, but many other services.

This means that current DSL, wireless, and cable modem services are completely inadequate for future needs. Current DSL offerings are in the range of one Mbps to three Mbps for most residential users, three Mbps to five Mbps for business DSL users, and there are severe distance limitations on DSL. Higher bandwidth is possible, but as the DSL bandwidth goes up, the distance it can be delivered goes down.

Typical wireless broadband (not cellular data service) offerings are in the range of 5 Mbps to 10 Mbps. Some wireless providers are rolling out 10-20 Mbps services. As bandwidth increases, the cost of the equipment also increases, and even a 20 Mbps service is well short of the FCC definition of broadband: 25 Mbps down and 3 Mbps up.

Across the U.S., current average bandwidth for cable modem services is typically 10 to 25 Mbps, with cable companies promising much more using the phrase "up to..." to obscure actual bandwidth being delivered.

The challenge for the area is to ensure that the businesses, residents, and institutions have a telecommunications infrastructure in place that will meet future needs.

Distance learning, entertainment, and video conferencing are three major applications of internet video. Distance learning from home with live video feeds requires high-performance two to five Mbps connections in the near term, the next two to four years. Over the next four to seven years, there will be many distance-learning courses that will incorporate live HD two-way video feeds, enabling students to participate in classroom discussions at a much higher quality level. Distance learning could be an important home-based application for workforce training and retraining.

U.S. homes now have more than half a billion devices connected to the Internet, according to a study by the NPD Group. Furthermore, the average number of connected devices per household is 10 and growing rapidly. This is more than three times the average number of people per household.

# 8 TECHNOLOGY ASSESSMENT

# 8.1 OVERVIEW OF THE TECHNOLOGY

In large portions of Craig County, broadband wireless will be an important strategy for improved Internet access for businesses and residents. But both fiber and wireless technologies and systems are going to be important to meet the goal of improving access to broadband. The rest of this section provides more detail and some specific build out strategies.

Businesses and residents may obtain Internet service:

- With a small radio directly attached to their home or business that receives a signal directly from a towers owned by a private provider, from a County-owned tower (e.g. shared with public safety use), or from a community-owned tower (e.g. a coop).
- With a small radio attached to a utility pole (60 or 70') to improve line of sight to a tower.
- With a small radio directly attached to their home or business that receives a signal from a "community" utility pole. The "community" pole will receive a signal from a distant tower and redistribute it locally to a cluster of customers (typically within a half mile).
- With a fiber connection to the fiber installed in areas where economic development is important, and in other areas as additional fiber network segments are added.

The table below summarizes how fiber and wireless can work together in a variety of ways.

Distribution Type	Access Type	Capacity
Wireless	Wireless	Typical customer connection starting at 5 to 10 Megabits, can be higher, with 50 Meg connections common. More dependent on the capacity of the wireless Distribution link.
Wireless	Fiber	Users can have fiber Gigabit connections locally, but total throughput dependent upon the capacity of the wireless link, which can be up to a Gigabit, depending on distance and budget.
Fiber	Fiber	Any amount of bandwidth needed, with standard connection typically a Gigabit (1,000 Megabits).
Fiber	Wireless	Typical customer connection starting at 5 to 10 Megabits, can be higher, with 50 Meg connections common.

# **8.2 WIRELESS TECHNOLOGIES**

WISPs (Wireless Internet Service Providers) use a wide variety of radio frequencies to deliver fixed point wireless broadband. By "fixed point," this means that these systems are not designed to support roaming in the way that cellular voice/data radios are (that is, mobile phone and data services).

Fixed point broadband is broadcast from a tower to individual homes and businesses (fixed points). Most of the frequencies used require clear line of sight between the tower and the location where service is desired.

Hilly topography can work for or against good wireless broadband service. Towers located on the tops of hills and mountains can provide service over a larger area than a tower in relatively flat terrain, but hills also block the signal. A residence can be a short distance from a large tower, but heavy tree cover or an intervening hill will block service. The solution to this can be addressed in several ways:

# More larger towers of 180' to 300'

The taller the tower, the wider the coverage, but as tower height increases, the cost of the tower also increases. Towers taller than 199' require a light at the top to make them visible to low-flying aircraft, and lighted towers are more expensive to erect, and the bulbs have to be changed periodically at significant expense. Many broadband towers are 180' to avoid the additional cost of lighting.

# Small cell broadband utility poles

Small cell broadband utility poles, often called community poles, are shorter towers or utility poles of typically 60' to 80', located in or very near a cluster of homes. The towers can be wooden utility poles or relatively low cost steel monopoles or steel lattice towers. These towers are located to get above local tree cover so that clear line of sight to a distant taller tower is available. Local access point radios provide service to homes and businesses with line of sight to the pole. In many parts of Craig County, these are going to be an important part of a strategy to get better broadband to rural residents and businesses.

# Variety of radio frequencies

WISPs are beginning to deploy a wider range of licensed and unlicensed radio frequencies to overcome distance, bandwidth, and line of sight issues. Traditional 2.4 Ghz and 5.7 Ghz WiFi and WiMax frequencies are being supplemented or replaced with LTE and CBRS licensed broadband frequencies that provide better bandwidth and will tolerate light tree cover better (2.5 Ghz, 3.5-3.7 Ghz). Some WISPs are also using lower frequencies (e.g. 900 Mhz) that will travel farther and will also provide better penetration in light tree cover.

# 8.3 EMERGING WIRELESS TECHNOLOGIES

#### MIMO Wireless

MIMO (Multiple Input, Multiple Output) describes a variety of technologies that can be summarized as using more than one receive and transmit antenna for wireless data applications. Wireless protocols that are using the MIMO concept include IEEE 802.11n (Wi-Fi), IEEE 802.11ac (Wi-Fi), 4G, LTE (Long Term Evolution), and WiMAX. Each of these protocols use the MIMO technology to increase the amount of available bandwidth in a given section of radio frequency spectrum.

New hardware is required to make effective use of MIMO. While the technology increases wireless bandwidth, the typical amount of bandwidth being used by wireless devices is also increasing rapidly. Some applications where MIMO is likely to provide noticeable improvements are in home wireless routers, where the effective throughput will be able to better handle the demanding bandwidth requirements of HD and 4K video streams. MIMO is slowly being developed for use with cellular smartphones, but both the phones and the cell tower radios have to be upgraded to support MIMO.

#### LTE/4G/5G

LTE (Long Term Evolution) is a set of protocols and technologies designed to improve the performance of voice/data smartphones. Like MIMO, both the user phone and the cell tower radios have to be upgraded to support LTE improvements. In 2013, only 19% of U.S. smartphone users were able to take advantage of LTE speeds, although that percentage has been increasing rapidly since then, and more than 85% of the U.S. cellular towers have been upgraded to LTE. As noted previously, the actual bandwidth available to a smartphone user is highly variable and depends on distance from the cell tower, the number of smartphones accessing the same tower simultaneously, and the kinds of services and content being accessed by those users.

The primary purpose of cellular bandwidth caps is to keep cellular users from using too much bandwidth and degrading the overall service. While LTE and MIMO improvements will improve overall cellular service, these technologies are not going to replace fiber to the home and fiber to the business.

In 2017, new fixed broadband wireless systems entered the marketplace using LTE frequencies, and many WISPs have begun to replace existing wireless radio systems with LTE equipment. These LTE systems do not provide any cellular voice services; they are designed specifically to support only broadband/Internet service.

In our conversations with both vendors of these systems and WISPs that have begun deploying them, we get two different stories. The vendors have been conservative in discussing the improvements, while some WISPs have been taking single user test results and suggesting that they will be able to deliver higher speeds at greater distances to all users.

There is little debate that the LTE equipment offers higher bandwidth, at somewhat greater distances, and with somewhat better penetration of light foliage and tree cover. Over the next two to four years, most WISPs will change out most of their existing radio systems for the improved LTE

To achieve the full benefit of 5G technology, more fiber is needed.

radios. Perhaps the most significant advantage of LTE fixed point broadband is its ability to provide better performance when clear line of sight between the customer and a tower is not available. LTE provides better penetration of light to moderate tree cover and other line of sight obstacles.

The official standard for 5G radio technologies was release in 2019, and many metro areas of the country now have 5G radio systems. It is worth noting that many smartphones, even some late model smartphones, do not have 5G support built in.

5G does bring much higher speeds to wireless broadband (e.g. it might be able to deliver 30 to 50 Meg of bandwidth consistently). But 5G has significant limitations that do not make it a good solution in rural areas of the U.S.

The fact that 5G can deliver much higher bandwidth means that 5G cell sites will require fiber connections. This is going to effectively limit 5G deployments to denser urban environments where both customers and fiber are plentiful.

There is no free lunch in the physics of radio frequencies. The higher bandwidth of 5G means that cell sites need to be closer together because the 5G frequencies do not travel as far as existing 4G/LTE frequencies currently being used by the cellular industry. Most users will have to be within 500 to 1,000 feet to receive 5G service.

Some experts estimate that more than a million miles of new fiber will have to be deployed just to support the 25 largest metro areas in the U.S. 5G will not appear overnight.

As many as 60 cell sites per square mile may be needed to make 5G widely available in a given area. If, as an example, about 25%, or about 82 square miles of Craig County is underserved, very conservatively, 740 or more cell sites would be needed to provide good coverage (as many as nine or ten cell sites per square mile).

For rural areas, the cost of 5G service may be one of the most significant obstacles. The cellular carriers see the increased customer bandwidth use possible on 5G networks as a major revenue opportunity. While they will increase the "standard" bandwidth package for monthly service, bandwidth caps and rate limiting is likely to keep 5G cellular customers bills high.

Many rural areas of Craig County county has poor or no cellular voice/data service, and somewhat counter-intuitively, more fiber can solve that problem. Cell towers need fiber backhaul connections to provide the best cellular data performance, and so rural fiber will also help address the issue of poor cellular service.

# White Space Broadband

White space broadband uses some of the frequencies that were formerly used by analog TV channels. These lower frequencies travel farther and provide better penetration of light foliage. Microsoft has been supporting a number of community white space experiments, and has promised much wider support for this technology, but there are few other users, equipment is still relatively expensive, and few WISPs have ventured into this still largely experimental technology. A Microsoft white space project in southern Virginia, although still underway, serves less than three hundred households and is still regarded as experimental. Other white space pilot projects have reported good results. One ISP experimenting with the technology has indicated that their trials with white space equipment has been able to deliver 50 Meg/50 Meg service.

# Low Earth Orbit (LEO) Satellite Internet

The Elon Musk-funded Starlink effort began offering "beta test" service in late 2020. There is a one time equipment and installation fee of \$499, and a monthly fee of \$99. The company is promising download speeds of between 50 Meg/sec and 100 Meg/sec and upload speeds of up to 20 Meg/sec. Latency is lower than traditional satellite Internet services. If the prices remain reasonable, this is likely to become a much better alternative to the older satellite Internet services.

In early fall of 2021, Starlink announced that the company would be moving the service out of beta, which would make the service more available to more users. The service has received generally favorable reviews from beta users in terms of speed and reliability. It will be important mostly for rural users who have line of sight problems for terrestrial fixed point wireless and for households and businesses that are completely outside the coverage area for fixed point wireless.

Service reports emerging in late 2021 indicated that Starlink was able to provide download speeds reliably at 50 Mbps to 75 Mbps, with a latency of 45 to 60 milliseconds. Low latency is critically important for good quality two way voice and video conversations.

By comparison, geosynchronous satellite service may have latency of ten to twenty times higher than Starlink. At the end of 2021, speed test results from the Ookla speed test service suggested that as Starlink is adding more customers, the average speed is flattening out, and Ookla's third

quarter 2021 data was showing Starlink with average 87 Mbps download and 14 Mbps upload speeds, and average latency of 44 milliseconds.

#### Millimeter Wave Service

Millimeter wave services use a variety of very high frequency wavelengths in range of 30 Ghz to 300 Ghz. An emerging wireless broadband service that uses the term "millimeter wave" covers very short wavelengths in the 71-76 GHz, 81-86 GHz, and 92-95 GHz (70/80/90 GHz) bands. These shorter wavelengths permit the use of very small antennas while still being able to provide high directivity and high gain. A primary advantage of the smaller antennas is the ability to use more of them and to make each individual antenna highly directional. The higher frequencies also permit transmission of much higher bandwidth. However, the higher bandwidth rates are distance limited.

In early testing in 2020, U.S. Cellular was able to demonstrate speeds of 100 Mbps at distances of three miles using 5G radio equipment (5G equipment is also close to the millimeter wave spectrum using lower frequencies of 24 Ghz, 28 Ghz, and 39 Ghz for some equipment). Radio equipment tests are often conducted in optimum conditions, and in real world conditions, the practical distance may be lower and the bandwidth may be lower, where buildings and trees can degrade or block the radio signals.

#### 8.4 DARK FIBER AND LIT FIBER

#### **About Dark Fiber**

Dark fiber is installed in conduit underground and/or hung on utility poles. It is called "dark" because no network electronics are installed to "light" the fiber (using small lasers in a fiber switch). For small municipal/local government fiber installations, dark fiber has a significant advantage in terms of management–very little ongoing operational responsibility is required.

Dark fiber is leased out to service providers, who install their own network electronics in cabinets or shelters attached to the fiber cables. The providers typically lease fiber pairs between the cabinet and their customers, and are responsible for all equipment-related management and maintenance. Dark fiber networks can be used by service providers to provision either Active Ethernet or GPON services to their customers.

Dark fiber networks do not generate large amounts of revenue, but this is offset by very low maintenance costs—primarily an emergency break-fix arrangement with a local or regional firm qualified to splice fiber. Emergency break-fix contracts are usually based on a time and materials basis, so there is little or no expense if there are no fiber breaks.

Other costs include "locates," which are called in to Virginia 811 (Miss Utility Hotline) and are performed by either the local Public Works department or a private sector contractor. For small fiber networks, locate costs are generally modest.

#### **About Lit Fiber**

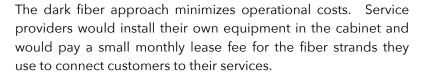
A "lit" fiber network includes the network electronics needed to transmit data over the fiber (using the small lasers in a fiber switch, hence there is light traveling over the fiber cable). In a lit network, "lit circuits" are leased out to service providers rather than fiber pairs. The muni/local government/ community network provides the network electronics, which reduces costs for the service provider—meaning they are able to pay higher lease fees for the circuits they use to deliver services (like

Internet) to their customers. Lit networks generate more revenue, but also have higher expenses because the network electronics have to be monitored and managed on a 24/7/365 basis (this task can usually be outsourced at reasonable cost). However, very small fiber deployments often do not pass enough homes or businesses to generate sufficient revenue to cover the higher costs.

Like dark fiber, a lit network incurs break-fix and locate costs as well.

#### 8.5 THE MEET-ME BOX CONCEPT

In some of the larger towns, some smaller communities, rural neighborhoods, and subdivisions, "meet me" boxes could be installed. A meet me box is a telecom cabinet with fiber cables installed between the cabinet and nearby homes and/or buildings. Providers only have to reach the meet-me box, lowering their costs. Both wireline and wireless providers can use this infrastructure. This approach can also be used to provide fiber services in business and industrial parks. A small Virginia county installed five miles of fiber in their business park and was able to attract a Tier One provider to provide service to an existing business (a manufacturing plant that was going to leave if the county did not help them get better Internet service).





For a meet-me box installed in a "main street" area (e.g in an alley behind commercial/retail buildings) with relatively inexpensive and short fiber drop cables into nearby buildings, the lower end of an installation might start at \$35,000. For a box installed in a rural sub-division that requires distribution conduit/fiber and drop cables, the cost to connect 25 homes might start at \$175,000 on the low end and increase as the number of homes connected increases. Larger numbers of homes or businesses will each add to the cost, but adding more connected premises also increases the value of the infrastructure and increases the revenue potential.

# 8.6 TERRAIN CHALLENGES

The propagation study map studies that are included later in this report illustrate the challenge of providing adequate fixed point wireless Internet service in Craig County. While the terrain is relatively flat, more towers and perhaps some community poles will be needed to near an adequate solution using fixed point broadband wireless. In some areas, the difficulty of obtaining line of sight for a radio link between two locations may dictate using fiber in place of wireless.

The propagation study map studies that are included later in this report illustrate the challenge of providing adequate fixed point wireless Internet service in Craig County. The mountainous terrain throughout the county shows that many towers and community poles will be needed to near an adequate solution using fixed point broadband wireless. In some areas, the difficulty of obtaining line of sight for a radio link between two locations may dictate using fiber in place of wireless.

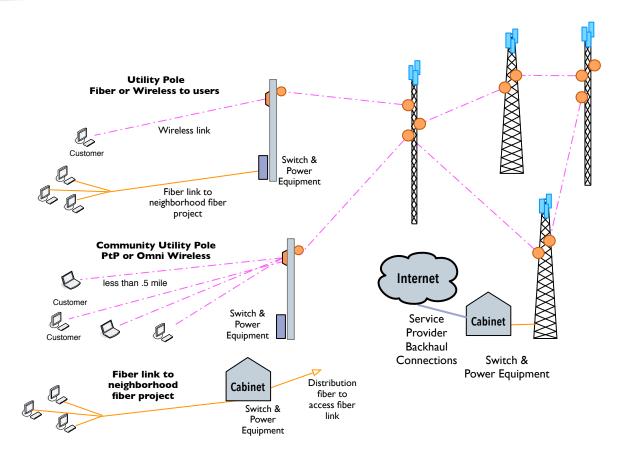
As an example, in Richwood, West Virginia, a group of about seventy-five homes along two and a half miles of road led to a fiber to the home solution that was less expensive than broadband wireless, primarily due to the cost of bringing electric service to many community poles. A combination of taller towers and shorter community poles may be needed to provide good service to most areas of Craig County.

#### 8.7 CONNECTIVITY SOLUTIONS

Both wireless and fiber networks, as well as legacy copper-based networks, all share three primary components. How these are designed and deployed can vary greatly, but all networks have these three parts in some form.

- The **Core Network** provides access to the Internet, a place for service providers (ISPs) to distribute their services locally on the network, and for larger institutional and business customers to meet service providers. Craig County has both landline and wireless service providers, but there are still areas that are underserved. Each of these providers has their own Core Network, but wireless broadband could be more widely available if additional county-owned towers were available to the private sector providers.
- The **Distribution** portion of the network connects the Core Network with collections of users. A Distribution network can include both fiber and wireless portions of a network.
- The Access or Last Mile portion of the network connects residential users and businesses to the network, and like the Distribution network, that connection will be by fiber or by a wireless link.

The illustration below shows the full range of technology options (fiber and wireless) and how they can be connected together in various ways to meet the diverse needs of the county. More detail is provided on the following pages.



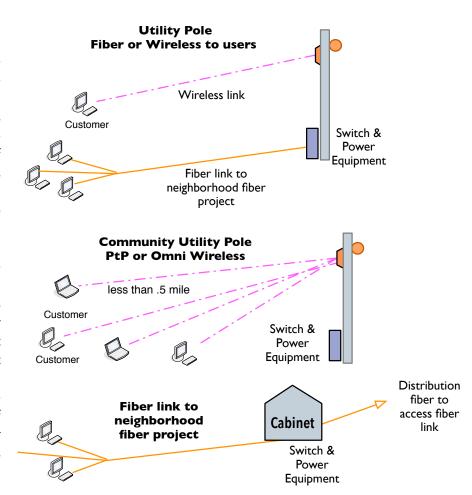
#### Last Mile Access

The Last Mile Access is the portion of the network that connects customers to their service provider and the Internet. Both broadband wireless and fiber links can be utilized to provide service. There are several ways that customers can receive service:

- Service providers can install their own local access radios on the Distribution towers, using both point to multi-point and point-to-point radios to deliver service to their customers.
- A single user utility pole (or inexpensive steel lattice tower) can be installed on the property of a single resident or business. A radio at the top of the pole receives service from another tower site (typically one of the Distribution towers).
- A utility pole (or inexpensive steel lattice tower) can be installed near a cluster of homes (e.g. a rural residential sub-division, several homes in close proximity on a rural road). Service providers can install their point to multi-point radios on this pole and provide economical service to several customers from a single pole.
- A utility pole (or inexpensive steel lattice tower) can be installed in a rural subdivision. A service provider installs a point to point radio on the pole, and fiber cable can be run from the pole past several homes to offer fiber service with wireless backhaul.
- Customers near existing fiber can have a fiber drop installed directly to their home or business.

# Distribution Network

Distribution is the portion of the network between the Distribution sites to the Last Mile Access portion of the network. It is desirable for each distribution site to have a connection back to more than one Distribution site (tower) on a redundant ring. This ring topology protects against hardware failure at the port level and does provide some protection if one of the tower to tower wireless links is disabled by an equipment failure.

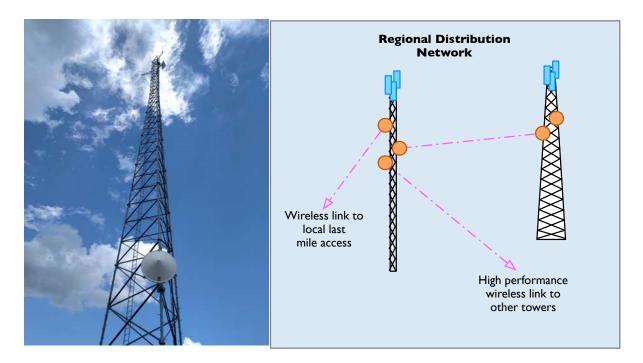


These tower sites are typically 120' to 180' tall to provide the height needed to enable Line Of Sight (LOS) between towers, and for local access, to enable service providers to mount point to multi-point radios on the towers.

Towers taller than 199' become subject to FAA regulations because the height can be a potential hazard to airplanes. Towers that exceed 199' usually have to be painted (alternating red/white) and have a blinking light at the top. These requirements increase the long term maintenance costs, but the taller towers can improve line of sight to other towers.

The towers can provide two functions:

- Space for backhaul connections to other towers in the county.
- Space for local access radios to provide Internet access within 2-3 miles of the tower (or farther with good Line Of Sight).



#### Core Network and Service Providers

In the past, the telephone company switch office (Central Office, or CO) has provided that function. Today, many communities have either a community-owned data center or a privately owned data center that offers an affordable range of options for customers of broadband services.

The Co-Location facility provides a meet point for various public and private fiber cables and networks to inter-connect. A local facility with space available for both public and private uses could help attract additional private sector investments (e.g. a long haul fiber provider wants connect to this facility because of increased access to customers).

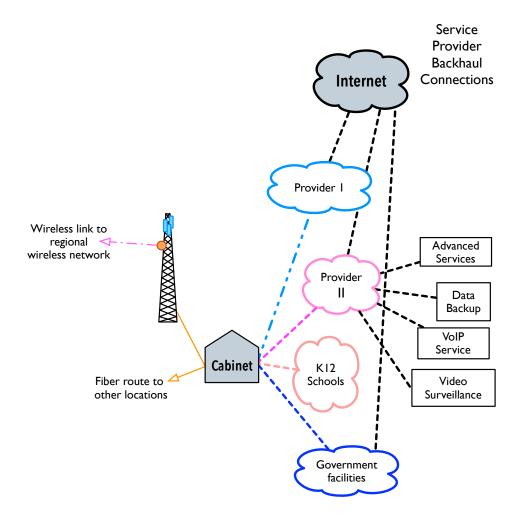
A colocation facility is a controlled environment (i.e. secure, heated, and air-conditioned) room with Internet access through wired and/or wireless systems. The colocation facility is a place where fiber, wireless, and copper-based network facilities meet. It is equipped to house high-end network equipment, servers, and other electronic gear.

A variety of middle layer network components and services can be located within the co-lo including, for example, directory services, replicated content servers, routing services, and other elements needed to deliver new multimedia services to the home and small office from multiple, competing providers.

Characteristics of the colocation facility are:

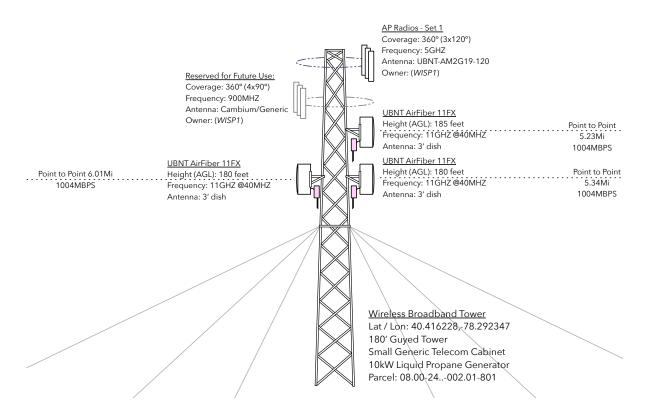
- A reliable source of AC electric power is required, with backup UPS (Uninterruptible Power Supply) service, and additional power backup available by an onsite generator is desirable.
- Controlled access to the facility (e.g. by electronic keycard) 24 hours/day, seven days a week. Service providers need to be able to gain access to the equipment room as needed, and work activities performed at night or on weekends is common.
- Racks for locating network equipment and servers, and optionally locked cages for equipment racks.

• Sufficient cooling capacity for the network's current and long-term needs. Equipment rooms require both a cool air input vent and an air return vent.



# 8.8 WIRELESS NETWORK ARCHITECTURE

The diagram below shows an example of the equipment typically placed on a tower, and details about the equipment that is planned. Several sets of Access Point radios can be placed on a tower operating in different frequencies, and can be owned/operated by multiple WISPs. Point to point radios link this tower to several other sites.



When developing wireless networks there are several categories of costs at each site. Construction of the network will incur site related costs at each tower site including:

- Site development clearing the site of trees and vegetation, construction of a tower road for access to the site, and strict adherence to all erosion and sediment control measures required by the Owner.
- Passive site equipment In most cases, a network cabinet will be installed and a new power service will need to be run to it. At each site there will be a generator and most likely a propane tank also installed. Reliable power systems will be installed inside the cabinets, and other equipment management solutions will be installed in the cabinet for network equipment.
- The tower itself new towers in this estimate are designed as 180' guyed towers. A guyed tower is usually a small profile lattice type tower that is supported by guy wires at several points on the tower. Guyed towers usually have a smaller visual profile than self supporting towers because they are narrow from the top all the way to the base. Self supporting towers will have the same lattice type structure but the tower widens as you get closer to the base. If the tower base is obscured by trees all around, a self supporting tower may be preferred. Some sites may require design changes based on site conditions. Other types of towers such as monopoles

could be considered for this project, especially if the owner is working with cellular providers on developing a site.

- Network equipment such as Point to Point radios, routers, switches, and access point equipment will be installed during the construction of this network. Since the network has built in redundancy the configuration will need to support automatic failover and other high-level network functions. In addition to the networking expertise needed to configure large networks such as this the contractor(s) configuring the network will need to understand spectrum management, wireless signal propagation, and other physical aspects specific to wireless networks.
- Permitting depending on the locality developing a wireless site usually requires extensive permitting processes that require a relatively long timeline and professional services.

# 8.9 SMALL CELL BROADBAND POLES

Line of sight issues are a constant problem for rural residents and businesses, as clear line of sight (or near line of sight) is required for fixed wireless Internet services. Even newer technologies like white space and LTE systems work better with clear line of sight to distant towers.

The increased use of wooden utility poles is already common in some other areas of the country, and increased use of this technique to get the customer CPE radio/antenna above tree cover is a relatively simple solution.

The utility poles would normally be placed on private property, subject to existing or updated ordinances governing the placement of wooden utility poles. The local government would have no responsibility for maintenance and repairs.

The cost of placing an eighty foot pole can range from a low of about \$2,000 to \$7,000 or more, depending on permitting, engineering requirements, and the location of the pole. Some municipalities provide "by right" permitting of these poles if they are placed on private property, which can reduce the cost of installing them.

Because these are placed on private land, local government would not have to provide any direct funding. However, the localities could encourage wider use of this option with a public awareness campaign developed in partnership with wireless providers. Local banks could be encouraged to provide low cost financing of the poles so that property owners could make a small interest and principal payment monthly over several years to reduce the financial impact.

This strategy requires minimal financial support from the County and that it has the potential of improving broadband access in rural areas of Craig County quickly. The County should work with WISP partners to promote this option to improve access to new and existing wireless broadband towers.





# 8.10 NANO-CELL AND WIFI CALLING SERVICE

A common complaint in Craig County is the poor cell service in many areas. In some parts of the county, there may be adequate broadband service via DSL or fixed point wireless Internet, but poor cellular phone/data service. There are now two solutions to improving rural cellular service that do not involve the expense or difficulty of attracting and/or building more cellular towers.

**WiFi Calling** – This approach takes advantage of the WiFi Calling feature that is now common in many late model cellphones. Once the phone is connected to a WiFi network (e.g. in the home using the home's broadband Internet service), the phone will automatically route the call over the WiFi network–phone calls and text work normally, as if the phone is connected to a cellular tower.

Nano-cell Calling – Poor or no cellular service in rural areas can be addressed by promoting the wider use of "nano-cell" devices. These small pieces of equipment are connected to the DSL or wireless broadband connection and provide improved cell service in the home or business. The working distance of these devices is limited, and service generally drops off once you leave the house itself (it may work for some short distance in the yard). These devices work very well and do not require an upgrade to a newer phone.



The cellular providers do not always promote the use of these devices, so many cellular users who would benefit from their use are not aware that this option is available. The device averages around \$200 retail, but the cellular providers often provide substantial rebates (50% discount or more) and in some cases may provide them at no charge.

The improved wireless broadband service will also support use of WiFi calling and/or nano-cell devices.

This strategy is important because improved broadband service can also improve cellular service without the need for more cellular towers, especially in parts of the county where cellular providers have not been able to make the business case for more towers.

# 9 BROADBAND CONNECTIVITY PROJECTS

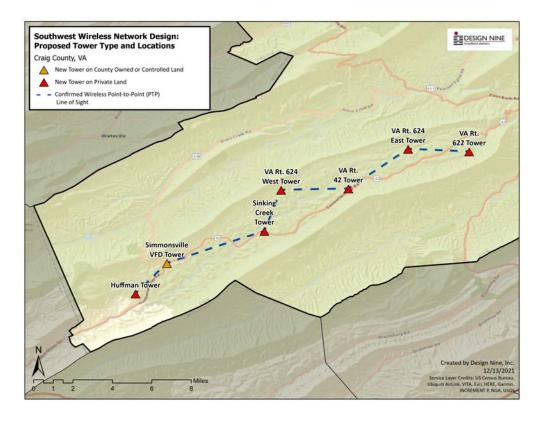
This section describes three broadband projects for Craig County.

- A fixed point wireless tower design that would bring fast broadband Internet to many homes on or near Route 42 in Sinking Creek Valley.
- A middle mile dark fiber route along Route 42 that could connect all of the proposed broadband towers together and provide an opportunity for an ISP to deliver fiber to the home in Sinking Creek Valley very economically.
- A study of fiber to the home in portions of New Castle.

# 9.1 WIRELESS NETWORK TOWER DESIGN

The network design in this section provides an affordable tower network in the Route 42 area of the county which has very poor service. In partnership with WISPs, the County could facilitate funding additional towers that could serve a significant portion of the county and eventually be expanded provide improved broadband coverage to most homes and businesses in the county. Wireless propagation studies were used to calculate coverage areas, and those studies included calculations that evaluated terrain and foliage coverage in the county. Where line of site to the proposed towers is poor, additional households and some small unserved pockets could be added by placing inexpensive utility poles.

This design assumes Wireless Internet Service Providers will build the towers or lease space on towers towers built by the County and supply their own access radios. Connectivity between towers could be provided by high performance microwave links and would enable providers to use those links to create a wide area broadband wireless network that would provide wireless customers with a minimum of 25 Meg down and 3 Meg up meeting the FCC "fully served" definition.



Consultation with interested service providers is essential and their input should be solicited and evaluated to determine where they can connect to one or more planned towers as the build out proceeds.

The County government may not need to build and/or own all of the towers. WISPs that receive state and/or Federal funding may choose to build their own towers, and the County may only need

to place a few towers in locations where household density is very low and private sector WISPs cannot make a business case for constructing their own tower.

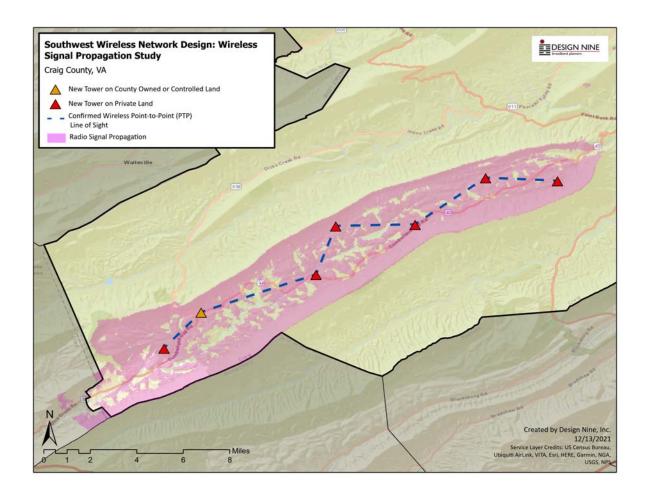
The wireless network design consists of seven new towers. The dotted lines indicate point to point connections between each tower, which creates a single broadband network along Route 42 in Sinking Creek Valley. The point to point connections (the dotted lines) have all been calculated to have adequate line of sight between towers and poles. A WISP could connect to the county-wide network at any one of the towers.

The County government would not be offering Internet services from any County-owned towers. Instead, space on the towers would be leased at affordable rates to private sector WISPs who want to expand their market area.

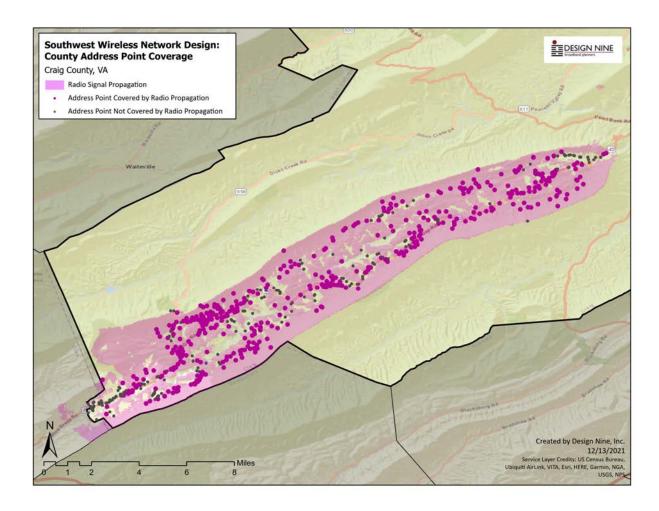
Leasing tower space is not a telecommunications service, and the County would not be selling Internet service to county residents and businesses.

SITE	DESCRIPTION	TOTAL COST
Huffman Tower	A new 180' tower constructed on private land that is bought or leased north of Huffman to serve Huffman and Surrounding rural areas Service Provider to Install wireless equipment. Point to point line-of-sight to only one other tower.	\$212,069
Simmonsville VFD Tower	A new 180' tower constructed on the site of Simmonsville Volunteer Fire Department to serve rural addresses in and around Simmonsville. Service Provider to Install wireless equipment. Point to point line -of-sight to at least two other towers.	\$203,425
Sinking Creek Tower	A new 180' tower constructed on private land along Rt 42 that is bought or leased to serve rural areas along Rt 42. Service Provider to Install wireless equipment. Point to point line-of-sight to at least two other towers.	\$221,425
VA Rt. 624 West Tower	A new 180' tower constructed on private land along Rt 624 that is bought or leased to serve rural areas along along the western end of Rt 624. Service Provider to Install wireless equipment. Point to point line-of-sight to at least two other towers.	\$221,425
VA Rt. 624 East Tower	A new 180' tower constructed on private land along Rt 624 that is bought or leased to serve rural areas along along the eastern end of Rt 624. Service Provider to Install wireless equipment. Point to point line-of-sight to at least two other towers.	\$221,425
VA Rt. 42 Tower	A new 180' tower constructed on private land along Rt 42 that is bought or leased to serve rural areas along Rt 42 between Thorny Hallow and Mountain Meadow Ln. Service Provider to Install wireless equipment. Point to point line-of-sight to at least two other towers.	\$221,425
VA Rt. 622 Tower	A new 180' tower constructed on private land along Rt 622 that is bought or leased to serve rural areas along Rt 622 and the eastern end of Rt 42. Service Provider to Install wireless equipment. Point to point line-of-sight to at least one other towers.	\$212,069

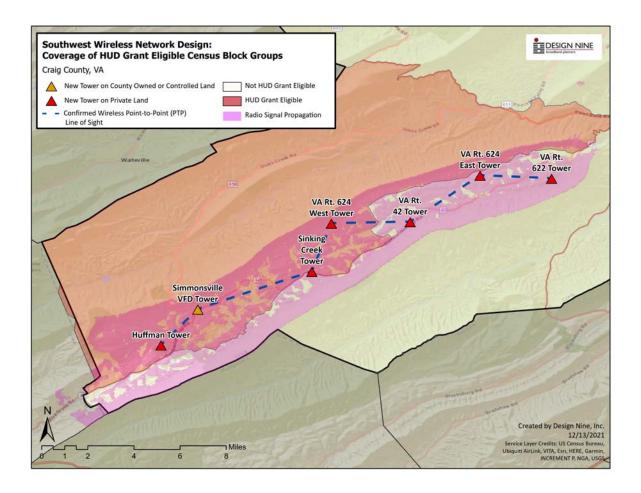
The map below shows the estimated radio signal propagation for the wireless project. Colored triangles indicate the type of tower site being developed.



This map shows the estimated signal coverage and includes the address points (households) that can potentially receive service within those shaded propagation areas. It is important to note that the propagation software does make an estimate of foliage and terrain when calculating signal propagation, trees, buildings, and other obstacles near a residence or business could degrade or limit coverage. In many cases, a wooden utility pole placed near the premises may improve line of sight to a tower and enable improved service.

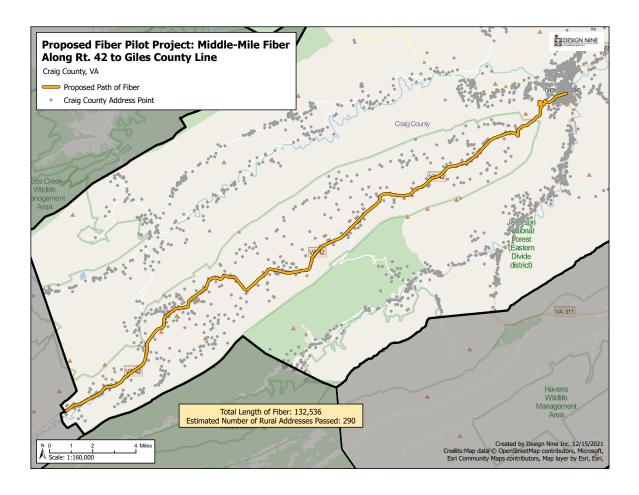


This map shows the estimated propagation of the county-wide wireless network, overlaid on areas of the county that are eligible for HUD grants. As many as four towers are in or are very close to HUD-eligible census tracts—the tower locations can often be moved slightly without affecting the overall radio signal propagation.



# 9.2 MIDDLE MILE FIBER COST ESTIMATE

The Route 42 area of the county has no fixed point wireless coverage, limited cellular coverage, and very limited (or no) fiber to the home coverage. A middle mile dark fiber network would benefit existing ISPs and WISPs by providing affordable high performance transport, and could also help attract additional providers to underserved areas of the county. The towers proposed in the previous section could all be connected together by this fiber, creating a highly robust fixed point wireless network.



This network would not offer any telecommunications services. It would provide only dark fiber leases and IRUs (Indefeasible Right of Use) agreements to qualified telecommunications companies.

The goal of this network would be to create partnerships with private sector ISPs and WISPs. A county-wide dark fiber network could accelerate the availability of fiber to the home to the more rural parts of the county and could also help WISPs improve the overall performance of their fixed point wireless networks by providing affordable high performance backhaul between both WISP-owned towers and any towers owned by the county.

The county would not be selling any telecommunications services. That would continue to be the domain of the private sector providers. The network could also improve access to county facilities

throughout the county, including fire and rescue locations, K12 schools, public safety communications towers, pump stations, water tanks, and other critical county infrastructure.

The route for the proposed dark fiber network was developed using data collected from the residential survey. Areas of the county that had clusters of reported low Internet speeds helped determine the routes.

Craig County Route 42 Middle-Mile Fiber Project Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Construction Materials	\$588,377
2	Distribution Labor	\$1,311,477
3	Structures, Cabinets, and Equipment	\$92,650
4	Drop Construction	\$59,375
5	Network Construction Subtotal	\$2,051,879
6	Project Management, Network Engineering, Integration, and Testing	\$246,225
7	Misc Fees, Advertising, Technical Services	\$20,519
8	Bookkeeping and Administration	\$15,389
9	Engineering, Permitting	\$192,242
10	Legal Costs	\$5,130
11	Other Costs Subtotal	\$479,505
12	Project Total	\$2,531,384
13	Contingency at 5%	\$126,569
14	Project Total (with contingency)	\$2,657,953

The table below categorizes the proposed fiber project costs from the table on the previous page according to Federal grant application form SF424. This should assist with the development of any Federal grant applications.

Craig County Route 42 Middle-Mile Fiber Project Route Overview

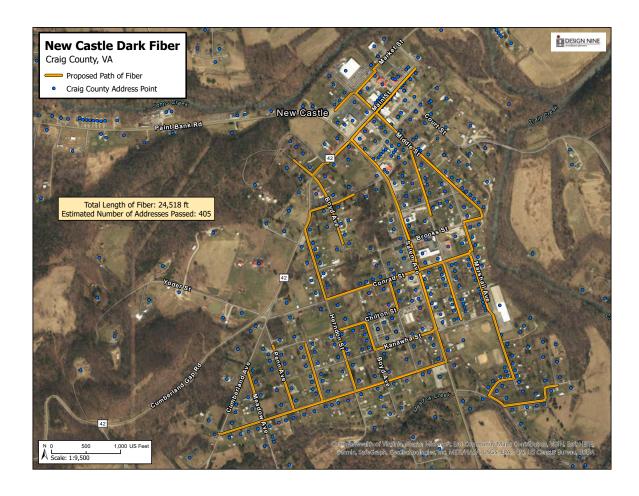
0		ITEM/PROJECT			
1	Miles of Fiber / Conduit Installed				
2	Number of Handholes Inst	alled	167		
3	Splice Closures Installed		167		
4	Cabinets Installed		5		
5	Number of Buildings Conr	nected	58		
6	Take Rate - Percentage of t	he Buildings Passed who are connected	20%		
7	Aerial - Percentage of construction expected to be installed on utility poles.				
8	Trenching - Percentage of construction installed by trenching				
9	Boring - Percentage of construction installed by horizontal drilling.				
10	Slot Cutting - Conduit installed in street by special methods.				
11	Rock Saw - Required where rock prevents the use of other methods.				
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow) 65%				
13	Aerial Info  2% Aerial is estimated to account for water body crossings and other obstacles to construction.				
14	Other Notes Estimated labor rates are based upon common rates seen for recent medium sized rural projects.				

### Craig County Route 42 Middle-Mile Fiber Project SF424 Summary

0	ITEM/PROJECT	ESTIMATED
1	Administrative and legal expenses	\$20,519
2	Land, structures, rights-of-way, appraisals, etc.	\$0
3	Relocation expenses and payments	\$0
4	Architectural and engineering fees	\$209,292
5	Other architectural and engineering fees	\$192,242
6	Project inspection fees	\$36,934
7	Site work	\$0
8	Demolition and removal	\$0
9	Construction	\$1,959,229
10	Equipment	\$92,650
11	Miscellaneous	\$20,519
12	SUBTOTAL (sum of lines 1-11)	\$2,531,384
13	Contingencies	\$126,569
14	SUBTOTAL	\$2,657,953
15	Project (program) income	\$0
16	TOTAL PROJECT COSTS (subtract #15 from #14)	\$2,657,953

# 9.3 NEW CASTLE FIBER TO THE HOME COST ESTIMATE

Certain portions of New Castle were not included in the C-B Electric grant proposal. This cost estimate provides a study of the cost of providing fiber to the home in those neighborhoods left out of the grant. An estimated 405 homes and businesses could be connected with fiber.



#### Fiber Pilot - New Castle Route Overview

0		ITEM/PROJECT	VALUE		
1	Miles of Fiber / Conduit Installed				
2	Number of Handholes I	nstalled	123		
3	Splice Closures Installed	1	71		
4	Cabinets Installed		1		
5	Number of Buildings Co	nnected	142		
6	Take Rate - Percentage o	of the Buildings Passed who are connected	35%		
7	Aerial - Percentage of construction expected to be installed on utility poles.				
8	Trenching - Percentage of construction installed by trenching				
9	Boring - Percentage of construction installed by horizontal drilling.				
10	Slot Cutting - Conduit installed in street by special methods.				
11	Rock Saw - Required where rock prevents the use of other methods.				
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow) 309				
13	Aerial Info  2% Aerial is estimated to account for water body crossings and other obstacles to construction.				
14	Other Notes Estimated labor rates are based upon common rates seen for recent medium sized rural projects.				

# Fiber Pilot - New Castle Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Fiber Pilot - New Castle Construction Materials	\$173,159
2	Fiber Pilot - New Castle Distribution Labor	\$392,941
3	Fiber Pilot - New Castle Structures, Cabinets, and Equipment	\$26,030
4	Fiber Pilot - New Castle Drop Construction	\$146,125
5	Network Construction Subtotal	\$738,255
6	Project Management, Network Engineering, Integration, and Testing	\$132,886
7	Misc Fees, Advertising, Technical Services	\$7,383
8	Bookkeeping and Administration	\$5,537
9	Engineering, Permitting	\$35,600
10	Legal Costs	\$7,383
11	Other Costs Subtotal	\$188,788
12	Project Total	\$927,043
13	Contingency at 5%	\$46,352
14	Project Total (with contingency)	\$973,395

The table below categorizes the proposed fiber project costs from the table on the previous page according to Federal grant application form SF424. This should assist with the development of any Federal grant applications.

Fiber Pilot - New Castle SF424 Summary

0	ITEM/PROJECT	ESTIMATED
1	Administrative and legal expenses	\$12,919
2	Land, structures, rights-of-way, appraisals, etc.	\$0
3	Relocation expenses and payments	\$0
4	Architectural and engineering fees	\$112,953
5	Other architectural and engineering fees	\$35,600
6	Project inspection fees	\$19,933
7	Site work	\$0
8	Demolition and removal	\$0
9	Construction	\$712,225
10	Equipment	\$26,030
11	Miscellaneous	\$7,383
12	SUBTOTAL (sum of lines 1-11)	\$927,043
13	Contingencies	\$46,352
14	SUBTOTAL	\$973,395
15	Project (program) income	\$0
16	TOTAL PROJECT COSTS (subtract #15 from #14)	\$973,395

# 9.4 TOWER AND WIRELESS NETWORK DEVELOPMENT ACTIVITIES

This section identifies the key tasks and timelines associated with identifying ISP partner(s) and tower sites.

# **Tower Site and Tower Development Process**

ACTIVITY	DESCRIPTION	DISCUSSION	TASKS
Issue Craig County partnership RFP	For many of the grant opportunities, a private sector ISP will be needed.	The RFP should be short and should not require large amounts of work from respondents. For best response, allow at least 45-60 days for ISPs to submit a response.	<ul> <li>Start RFP development by obtaining sample RFPs from other localities.</li> <li>Develop draft RFP and have it reviewed.</li> <li>Issue RFP.</li> <li>Review responses and conduct interviews as needed.</li> <li>Select best candidate.</li> </ul>
Assess and inventory prospective tower sites in Craig County	Craig County applications for wireless towers require specific locations for towers.	Use report data to identify where towers are needed.	<ul> <li>Appoint someone to lead tower site effort.</li> <li>Assemble a list of locations from report data.</li> <li>Begin meeting with property owners to determine willingness to provide space for tower and availability of road access and electric service.</li> <li>Collect site agreements.</li> </ul>

# Tower Site and Tower Activities

TASKS	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
Obtain sample ISP partner RFPs												
ISP RFP development and review												
Issue RFP for ISP partner(s)												
Review responses and conduct interviews												
Select ISP partner(s)												
Appoint site identification team												
Collect prospective sites												
Meet with property owners												
Collect site agreements												

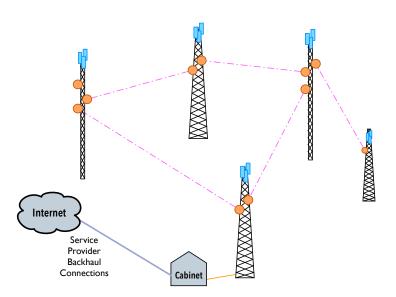
#### 9.5 TOWER COST DETAIL

#### **About Wireless Tower Cost Estimates**

The line items for each named tower include the cost of the tower, site preparation, estimated cost of electric service, generator cost and placement, cost of the tower, and labor to assemble and erect the tower, and backbone equipment.

This section of the report provides an estimate of the cost of using existing towers to provide improved Internet access. The diagram below shows the logical design of a five-tower network. Four of the five towers have adequate line of sight between the towers to build a fully redundant ring between the towers, which will provide much more reliable service, because a single tower or equipment failure will not affect service.

Any placement of new towers should be preceded by a careful viewshed analysis of how much area/users are likely to be able to receive service. Site acquisition and site preparation costs can affect the overall cost of such a project. Existing county properties (e.g. fire/rescue stations, county parks, dump transfer sites, etc.) may be candidates for towers. Note that existing towers may require an engineering study to confirm that additional antennas can be added without exceeding the tower load limits.



#### **Existing Tower Improvements**

For existing towers owned by the state, the county, or other stakeholders that might be candidates for project use, modest upgrades to equipment at the base of the tower would be needed to make them broadband-ready.

Upgrades to existing towers typically may include adding or upgrading generators, additional cabinet or shelter space for service provider equipment, and sometime fencing and physical access changes.

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

#### Existing Tower Development and Improvements (Fit-up)

ITEM/PROJECT	UNITS	UNIT COST (LOW)	UNIT COST (HIGH)	COST (AVG)
Tower Study / Survey	1	\$4,500	\$7,000	\$5,750
Site Development (Clearing, Road Improvements, etc.)	1	\$0	\$1,500	\$750
Small Telecom Cabinet AmProd AM47P-2636-24RU or Equivalent	1	\$6,000	\$7,500	\$6,750
10kW Liquid Propane Generator	1	\$4,000	\$6,000	\$5,000
Cabinet Foundation and Installation	1	\$2,500	\$4,000	\$3,250
New Power Service / Installation (assumes power available on-site)	1	\$1,500	\$2,500	\$2,000
Power System Installation Labor	1	\$300	\$500	\$400
Generator Installation Labor	1	\$1,250	\$1,700	\$1,475
Propane Service Installation - tank and install by local gas company	1	\$750	\$1,250	\$1,000
Poject management				\$10,000
Total:				\$36,375

#### **New Tower**

New towers have a range of configurations and cost options. This estimate is for a new 180 ft bare tower with no radio equipment. If located on existing county properties, the time needed to plan for construction can be shortened. If site acquisition or a site lease of private property is required, purchase or lease negotiations can add several months to the process. Note that a full permitting process may be required even if a new tower is placed on existing county-owned property. The permit process can add 60 to 120 days to the time needed to put a new tower in service.

#### New Tower Costs (180' Guyed)

ITEM/PROJECT	UNITS	UNIT COST (LOW)	UNIT COST (HIGH)	COST (AVG)
Labor and Contracting: \$82,640				
Site Development (Clearing, Road Improvements, etc.)	1	\$15,000	\$15,000	\$15,000
New Power Service / Installation	1	\$1,250	\$3,450	\$2,350
180' Guyed Tower Construction Labor & Contracting	1	\$50,000	\$74,750	\$62,375
Cabinet Installation Labor	1	\$600	\$1,150	\$875
Power System Installation Labor	1	\$300	\$575	\$438
Generator Installation Labor	1	\$1,250	\$1,955	\$1,603
Materials: \$35,735				
180' Guyed Tower Construction Materials	1	\$17,500	\$27,500	\$22,500
Small Telecom Cabinet	1	\$4,000	\$6,000	\$5,000
Cabinet Foundation and Installation Materials	1	\$1,000	\$1,500	\$1,250
10kW Liquid Propane Generator	1	\$4,000	\$6,000	\$5,000
Spare Fuses	1	\$10	\$20	\$15
Power System Installation Materials	1	\$20	\$40	\$30
Samlex 1000W Inverter	1	\$350	\$450	\$400
Samlex SEC1230-UL Battery Charger	1	\$200	\$300	\$250
100ah 12v Non Spillable Backup Battery	4	\$250	\$350	\$1,200
DC Voltage Monitoring Device	1	\$40	\$60	\$50
Unmanaged Rack Mount PDU (60)	1	\$35	\$45	\$40
Total:				\$118,375
Project Management, Network Design				\$37,500
Site Engineering, Surveying, Viewshed Analy		\$9,500		
Misc Fees, Technical Services	\$7,500			
Contingency				\$11,838
TOTAL:				\$184,713

#### **New Community Pole**

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

If there were twenty homes that could receive service and the cost of the pole and equipment was \$12,000, each household connected would have a one-time cost of \$600. There could be a matching grant program where each county could provide 50% of the cost of putting the pole and equipment in place, and the balance would have to be developed from other sources. Some localities are using this concept to offer WISPs exclusive access to the pole in return for a portion of the construction costs.

Pole costs vary depending upon what equipment is installed. Point-to-point link radio costs vary with distance from a nearby tower. More information is contained in Chapter Six - Small Cell Broadband Poles.

#### Neighborhood Pole Costs

ITEM/PROJECT	UNITS	COST (LOW)	COST (HIGH)	COST (AVG)
Site Development (Clearing, Road Improvements, etc.)	1	\$0	\$2,000	\$1,000
3x3 NEMA Box	1	\$300	\$600	\$450
New Power Service / Installation	1	\$500	\$1,250	\$875
60' Wooden Utility Pole Construction Materials	1	\$2,500	\$3,500	\$3,000
Unmanaged Rack Mount PDU (60)	1	\$35	\$45	\$40
60' Wooden Utility Pole Construction Labor & Contracting	1	\$2,000	\$3,000	\$2,500
Neighborhood Pole Coordination and Project Management				\$5,000
Total:				\$12,865

#### Point-to-Point Links

The table below show the cost of a backhaul radio installation, with one licensed radio set (AirFiber 11FX). The licensed radios are less susceptible to interference and have higher bandwidth. A regional backhaul network between towers has several desirable characteristics:

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

A tower in a larger network may have one, two, or several backhaul radios included, and number of radios depends on the tower's location in the network and how many other towers it is connected to using point to point link pairs.

#### Licensed PTP Radio - Single Side - AirFiber 11FX

ITEM/PROJECT	UNITS	UNIT COST	COST
AF11X Radio	1	\$799	\$799
AF11-CA Adapter Kit	1	\$49	\$49
AF11FX Duplexer	2	\$199	\$398
AF11 X Antenna 11GHz, 35dBi	1	\$379	\$379
FCC Licensing	0.5	\$2,000	\$1,000
Shipping @ 5%	1		\$131
Point to Point Link Assembly, Installation, Alignment, and Testing	1	\$3,600	\$3,600
Project Management, NIIT	0.5		\$3,000
TOTAL			\$9,356

#### 9.6 ESTIMATED TIMELINES FOR COMPLETION

Each kind of project will have its own timeline, and will vary widely depending on the type of funding. Grant-funded projects may need six months to one year to plan and apply for funding, depending on where in the grant cycle the network owner commits to applying for a grant and the length of time that the grant agency takes to review and approve grants.

Tower improvements and construction times can be dependent on weather (more weather related delays are likely in late fall through early spring) and on procurement. Most grant-funded projects require careful attention to a public procurement process, which can add 90 to 180 days to the timeline.

#### **Broadband Construction Timetable**

Project Type	Project Execution Planning	Project Procurement	Project Engineering and Construction	Total Estimated Timeline
Improvements to existing towers	2-3 months	3-4 months	2 months	7-9 months
New towers of 180 ft	4-6 months	4-5 months	4-8 months	12-19 months
Small cell community broadband poles	3 months	2 months	2 months	7 months
Public WiFi Hotspot	3 months	1 month	1 month	5 months
Point to point tower backhaul links	2-3 months	3-5 months	1-2 months	6-10 months
Fiber to the home/ business projects	4-6 months	4-6 months	6-12 months	14-24 months

## 9.7 MIDDLE MILE FIBER NETWORK DESIGN AND COST ESTIMATE

This map using the survey response data to develop heat maps of the areas that reported low Internet speed.

The three tables below provide the cost detail for the "Main Loop" proposed dark fiber network (noted in red on the maps). The orange route is a "connector" to provide more fiber availability in the east-center portion of the county, and the cost tables for that follow the Main Loop tables.

#### \_\_\_\_\_ Middle Mile Dark Fiber Main Loop Route Overview

0		ITEM/PROJECT	VALUE			
1	Miles of Fiber / Conduit Ins	stalled	109.05			
2	Number of Handholes Inst	alled	720			
3	Splice Closures Installed		720			
4	Cabinets Installed		22			
5	Number of Buildings Connected					
6	Take Rate - Percentage of the Buildings Passed who are connected					
7	Aerial - Percentage of construction expected to be installed on utility poles.					
8	Trenching - Percentage of construction installed by trenching					
9	Boring - Percentage of construction installed by horizontal drilling.					
10	Slot Cutting - Conduit insta	alled in street by special methods.	0%			
11	Rock Saw - Required where	e rock prevents the use of other methods.	0%			
12	Direct Bury - Conduit insta	lled by direct bury methods (plow, vibratory plow)	65%			
13	2% Aerial is estimated to account for water body crossings and other obstacles to construction.					
14	Other Notes  Estimated labor rates are based upon common rates seen for recent medium sized rural projects.					

#### \_ Middle Mile Dark Fiber Main Loop Cost Summary

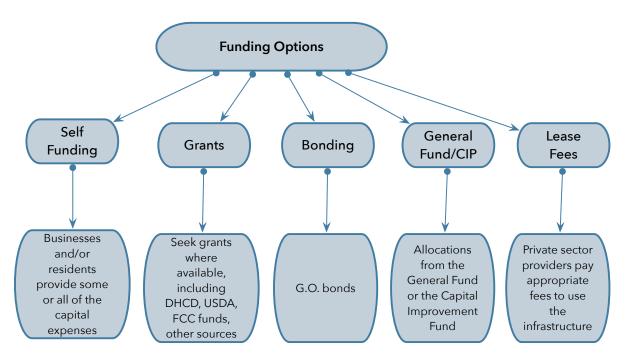
0	ITEM/PROJECT	ESTIMATED
1	St. Croix Middle Mile Dark Fiber Main Loop Construction Materials	\$2,629,264
2	St. Croix Middle Mile Dark Fiber Main Loop Distribution Labor	\$5,676,574
3	Middle Mile Dark Fiber Main Loop Structures, Cabinets, and Equipment	\$407,660
4	St. Croix Middle Mile Dark Fiber Main Loop Drop Construction	\$555,850
5	Network Construction Subtotal	\$9,269,348
6	Project Mgmt, Network Engineering, Integration, and Testing	\$1,112,322
7	Misc Fees, Advertising, Technical Services	\$92,693
8	Bookkeeping and Administration	\$69,520
9	Engineering, Permitting	\$834,887
10	Legal Costs	\$23,173
11	Other Costs Subtotal	\$2,132,596
12	Project Total	\$11,401,944
13	Contingency at 5%	\$570,097
14	Project Total (with contingency)	\$11,972,041

The table below categorizes the proposed middle mile dark fiber project according to Federal grant application form SF424. This should assist with the development of any Federal grant applications.

# 10 INFRASTRUCTURE FUNDING AND GRANT OPPORTUNITIES

It is important to note that any investment by county government in broadband infrastructure should be focused on passive infrastructure. Passive infrastructure can be leased to private sector service providers, generating long term revenue for maintenance and expansion. Leasing passive infrastructure like towers and dark fiber is not a "telecommunications service." In Virginia, a Broadband Authority is generally needed if telecom services are going to be offered.

These assets will have a conservative life span of thirty years or more (e.g. wireless towers, conduit, fiber cable). These types of infrastructure investments create hard assets that have tangible value and can then be leveraged for additional borrowing. The demand for services and the associated fees paid for those services will provide the revenue that will pay back loans over time. There is ample time to recoup not only the initial capital investment, but also to receive regular income from the infrastructure.



The financing of local government and/or community-owned telecommunications infrastructure faces several challenges with respect to funding.

- Not all local governments are willing to commit to making loan guarantees from other funding sources like property taxes, because the idea of community-owned telecom infrastructure has a limited track record and therefore a higher perceived risk.
- Similarly, citizens are not always willing to commit to the possibility of broadband fees or higher taxes that may be needed to support a telecom infrastructure initiative, for many of the same reasons that local governments are still reluctant to make such commitments: perceived risk and a lack of history for such projects.

• Finally, banks and investors are also more skeptical of community telecom projects because of the relative newness of the phenomenon. By comparison, there are decades of data on the financial performance of water and sewer systems, so the perceived risk is lower.

Somewhat paradoxically, the cost of such a community digital road system is lower when there is a day one commitment to build to any residence or business that requests service. This maximizes the potential marketplace of buyers and attracts more sellers to offer services because of the larger potential market. This is so because:

- Service providers are reluctant to make a commitment to offer services on a network without knowing the total size of the market. A larger market, even if it takes several years to develop, is more attractive.
- Funding agencies and investors that may provide loans and grants to a community network project want to know how the funds will be repaid and/or that grants will contribute to a financially sustainable project. Knowing that the size of the customer base is the maximum possible for a service area helps reduce the perceived risk for providing loans and grants.

#### 10.1 VIRGINIA FUNDING OPPORTUNITIES

The Virginia Telecommunications Initiative (VATI) continues to receive steady increases in annual allocations from the state legislature. VATI funds are typically disbursed for public/private partnerships between a Virginia locality and a qualified ISP or WISP. Some match is required. For 2022, applications are due in August (2022). VATI awards vary widely in size. ARPA funds for 2022 should become available in late winter or early spring of 2022.

Craig County should maintain regular communications with the Virginia Department of Housing and Community Development to pursue every possible broadband funding opportunity.

#### 10.2 ARPA (AMERICAN RESCUE PLAN ACT) FUNDING

The American Rescue Plan Act of 2021, is the biggest federal funding program for broadband projects. ARPA has \$350 billion in funding. Each state receives an ARPA fund allocation, and how much is targeted toward broadband initiatives will be decided by a state legislative committee and/or the governor of the state.

The 2020 CARES (Coronavirus Aid, Relief, and Economic Security Act ) funding was typically distributed by state governments to localities (e.g. counties, towns, cities), which were then able to make decisions on how to spend the money within both the state and Federal guidelines attached to the funds.

ARPA funding has fewer requirements and "strings" attached than many other Federal broadband grant programs, and Carroll County should make obtaining ARPA funds for county broadband projects a priority in late 2021 and early 2022.

The Virginia Commonwealth Connect Web site has extensive information on grant programs, legislation, partnerships, and related broadband information (https://www.commonwealthconnect.virginia.gov/).

#### 10.3 HUD COMMUNITY DEVELOPMENT BLOCK GRANTS

The U.S. Housing and Urban Development CDBG State Program allows the Wisconsin state government to award grants to smaller units of general local government (e.g. counties, towns) that develop and preserve decent affordable housing, to provide services to the most vulnerable in our communities, and to create and retain jobs. In recent years, CDBG funds have been successfully used for broadband infrastructure development where the local government applicant can show the improvements meet the general guidelines of the program—so grant funds have to spent in low and moderate income areas.

Over a 1, 2, or 3-year period, as selected by the grantee, not less than 70 percent of CDBG funds must be used for activities that benefit low- and moderate-income persons. In addition, each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available. More information is available here (https://www.hud.gov/program\_offices/comm\_planning/communitydevelopment/programs).

#### 10.4 USDA RECONNECT PROGRAM

The ReConnect program is a new funding program managed by the USDA Rural Development Office. This program is sometimes called the USDA e-Connectivity pilot program. Grant applications can be a combination of 100% grant, 50% grant/50% loan, or 100% loan. \$1.1 billion has been allocated to the program for 2022, and a wide variety of entities can apply, including non-profits, coops, and state and local governments.

As much as \$200 million will be available for loans, with another \$250 million allocated for loan/grant combinations. A \$350 million fund will be distributed with a 25% matching requirement and another \$350 million in grants with without a match, for projects in tribal and socially vulnerable communities. Applications are due in the spring of 2021, and USDA will begin accepting applications in late 2021. More information is available here: (reconnect.usda.gov). A mapping tool is available on the Web site to show areas that are eligible. To qualify as an eligible area, households must have less than a minimum of 10 Megabit down/1 Megabit up broadband service.

#### 10.5 911 FEES

Improved broadband access in the county can improve household access to 911 services by using broadband Internet to carry 911 voice calls, using one or more strategies to include:

**WiFi calling** – now a commonly available feature on new cell phones. WiFi calling switches voice telephone call from the cellular network to a nearby WiFi Internet network seamlessly. The reduces the need for additional large cell towers in low density areas of the county.

**Nano-cell Devices** – Nano-cells are a small box attached to a home wireless router. The nano-cell, which is typically obtained from the cellular provider, enables a cellphone to operate inside the home or business even if there is no cell tower near by.

A modest increase in the 911 fee to improve 911 access in rural areas of the county could generate funds to support additional broadband towers and community poles, but this approach would require legislative changes at the state level—which has been a topic of discussion in Charleston. See the tables above in the Special Assessment section of this chapter.

#### **10.6 OPPORTUNITY ZONES**

An Opportunity Zone is an economically-distressed community where new investments, under certain conditions, may be eligible for preferential tax treatment. Localities qualify as Opportunity Zones if they have been nominated for that designation by the state and that has been approved by the Internal Revenue Service. Opportunity Zones are designed to create tax incentives for private investors to make investments that can encourage economic development and job creation in distressed communities. Opportunity Zones would be of most use for Internet Service Providers who could use the tax benefits to make a business case to improve Internet access in a qualifying area (zone).

Opportunity Zones are defined by census tract, and the Census Bureau's Geocoder online tool can provide census tract ID numbers. A link to the list of currently qualified census tracts can be found on this page (https://www.cdfifund.gov/opportunity-zones). Craig County does not appear to have any designated Opportunity Zones.

#### 10.7 BONDING

Revenue bonds are repaid based on the expectation of receiving revenue from the network, and do not obligate the local government or taxpayers if financial targets are not met. In that respect, they are different from general obligation bonds. Many kinds of regional projects (water, sewer, solid waste, etc.) are routinely financed with revenue bonds. We believe many community projects will eventually finance a significant portion of the effort with revenue bonds, but at the present time, the limited financing history of most community-owned broadband networks has limited using revenue bonds.

Selling revenue bonds for a start up municipal network can be more challenging because there is no financial or management history for the venture. Bond investors typically prefer to see two or three years of revenue and expenses and a track record of management success. It would be advisable for the county to have an early conversation with qualified municipal bond counsel to assess the viability of this approach. However, the Covid crisis and the subsequent increase in demand for better broadband seems to encouraged the bond market to regard muni broadband financing as less risky than in past years.

Obtaining funding using revenue bonds requires an excellent municipal credit rating and an investment quality financial plan for the operation and management of the network. Revenue bonds must be used carefully, and a well-designed financial model is required to show investors that sufficient cash flow exists to pay back the loans.

General obligation bonds are routinely used by local governments to finance municipal projects of all kinds. G.O. bonds are guaranteed by the good faith and credit of the local government, and are not tied to revenue generated by the project being funded (i.e. revenue bonds). G.O. bonds obligate the issuing government and the taxpayers directly, and in some cases could lead to increased local taxes to cover the interest and principal payments. Some bond underwriters have indicated a willingness to include telecom funds as part of a larger bond initiative for other kinds of government infrastructure (e.g. adding \$1 million in telecom funds to a \$10 million bond initiative for other improvements).

In discussions with bond underwriters, it has been suggested that it would be easier to obtain bond funds for telecom if the telecom bonding amount was rolled into a larger water or sewer bond, or some other type of bond request that are more familiar to the bond market.

#### 10.8 RDOF/CAF2 FUNDING

The second round of the FCC Connect America Fund (CAF2) (Rural Digital Opportunity Fund) continues to provide funds to incumbent and competitive service providers. The funds must be used in unserved or underserved areas as defined by Federal census blocks. To be eligible, a census block could not have been served with voice and broadband of at least 10/1 Mbps (based on Form 477 data) by an unsubsidized competitor or price cap carrier.

The FCC published the final eligible census blocks for the auction on February 6, 2018. The final areas were based on FCC Form 477 data as of December 31, 2016 (the most recent publicly available FCC Form 477 data at the time). So there is a time lag between the determination of a qualifying census block or blocks and the schedule for submitting a bid to serve those areas. The first round of funding was announced in early 2021, and was immediately met with widespread criticism. SpaceX (Starlink) was awarded almost \$900 million, and it may have to return some of those funds because the company appears to have included some ineligible census blocks. Many large incumbents also received substantial awards when some smaller ISPs that might have offered competition to the incumbents received much less or no funds.

Because many CAF2 qualifying areas are only served by low performance DSL (e.g. less than 10/1 Mbps service), incumbent carriers use the awards to upgrade DSL switches, which is not a long term solution. More recently, competitive carriers are applying for CAF2 funds to provide higher performance broadband wireless and in some cases fiber to the home. Because the use of CAF2 funds are so restricted, it has not had as much impact as many hoped. The FCC, as of fall 2021, has not announced the rules for the second round of funding.

#### 10.9 LEASE FEES

Initiatives like tower access and access to local government-owned conduit and fiber can create long term revenue streams from lease fees paid by service providers using that infrastructure. The City of Danville, Virginia has recovered their entire initial capital investment from lease fees paid by providers on the nDanville fiber network.

#### 10.10 COMMUNITY REINVESTMENT ACT

The Community Reinvestment Act (CRA) was developed forty years ago to encourage banks and savings institutions to help meet the credit needs of their local communities, with a focus on low and moderate income areas of those communities. The Federal agencies that oversee private banks assign a CRA rating to each institution. Banks are often looking for well-planned community efforts that need loans. Such loans can improve a bank's CRA rating.

The CRA was revised in 2016 to encourage banks to support community broadband efforts. A community broadband project may be able to get some loan financing from a local bank that wants to get credit for their CRA work.

#### 10.11 COOP MEMBERSHIP FEES

Coop members pay a one time membership fee to join the coop. For fiber and wireless improvements, this fee could be set at a level that pays for part or all of the cost of building the fiber to the business or residential premises and/or placing the towers and equipment to deliver wireless service. It may also be possible to work with local banks to provide a financing option (e.g. the membership fee could be paid monthly over a period of several years to reduce the financial burden on a household or business).

The coop membership fee offers the area a way to self-finance a substantial portion of the initial network, as well as providing a long term framework for expansion.

#### 10.12 CONNECTION FEES

Tap fees, pass by fees, and connection fees are already commonly used by local governments for utilities like water and sewer. The revenue share model can be strengthened from additional sources of revenue, including one time pass by fees, connection fees and sweat equity contributions. It is important to note that the Coop Membership Fee can be treated as a connection fee in whole or in part.

**Pass By Fees** - Pass by fees could be assessed once the fiber passes by the property, just as some communities assess a pass by fee when municipal water or sewer is placed in the road or street-and the fee is assessed whether or not the premise is connected, on the basis that the value of the property has been increased when municipal water or sewer service passes by. At least one study has indicated that properties with fiber connections have a higher value by \$5,000 to \$7,000 that similar properties without fiber access.

One Time Connection Fees - A one time connection fee can be assessed to property owners (e.g. residents and businesses) when the fiber drop from the street to the premise is installed. This is similar to the kinds of connection fees that are typically charged when a property is connected to a municipal water or sewer system. The fee is used to offset the cost of the fiber drop and the Customer Premise Equipment (CPE) needed to provide the operational access to the network. The connection fee can be modest (e.g. \$100) or it can be a larger percentage of the actual cost of the connection. Fiber CPE may range from \$250 to \$350 and a fiber drop may cost from \$200 for a premise very close to the distribution fiber passing along the property to \$1,000 or more if the premise is hundreds of feet from the road. One variant would be to charge a minimum connection fee for up to some distance from the road (e.g. \$100 for up to 75' and \$2 for each additional foot).

There is already some data that indicates that residential property values increase by as much as \$5,000 to \$7,000 if fiber broadband services are available, so pass by fees can be justified on the basis of increased property values accruing to the property owner. Given the novelty of this approach, pass by fees may need more time to become an accepted finance approach, but tap fees (for installing the fiber cable from the street or pedestal to the side of the home or business) may be easier to use, especially for businesses that may need improved broadband access. Tap fees have the potential of reducing the take rate in the early phases of deployment, but as the value of the network becomes established, it is likely that there will be much less resistance to paying a connection fee.

#### 10.13 NEW MARKETS TAX CREDIT

New markets tax credits are a form of private sector financing supported by tax credits supplied by the Federal government. The New Markets Tax Credit (NMTC) Program permits taxpayers to receive a credit against Federal income taxes for making qualified equity investments in designated Community Development Entities (CDEs). The CDEs apply to the Federal government for an allotment of tax credits, which can then be used by private investors who supply funds for qualifying community projects. Substantially all of the qualified equity investment must in turn be used by the CDE to provide investments in low-income communities.

The credit provided to the investor totals 39 percent of the cost of the investment and is claimed over a seven-year credit allowance period. In each of the first three years, the investor receives a credit equal to five percent of the total amount paid for the stock or capital interest at the time of purchase. For the final four years, the value of the credit is six percent annually. Investors may not redeem their investments in CDEs prior to the conclusion of the seven-year period.

Throughout the life of the NMTC Program, the Fund is authorized to allocate to CDEs the authority to issue to their investors up to the aggregate amount of \$19.5 billion in equity as to which NMTCs can be claimed.

These tax credits can be quite useful, and there may be some areas that qualify. However, it can take up to a year or more to apply and then finally receive NMTC-related cash. This can be a useful long term source of funds.

#### 10.14 SPECIAL ASSESSMENT/SERVICE DISTRICT

Communities like Bozeman, Montana and Leverett, Massachusetts have been funding broadband infrastructure improvements with special assessments (in Leverett, \$600/year for five years), and in Bozeman, TIF (Tax Increment Funding) is being used in some areas to add telecom conduit, handholes, and dark fiber. In some localities, it is possible to levy a special assessment in a service district designated for a particular utility (like broadband) or other kind of public service.

Charlemont, Massachusetts intends to add an \$11/month assessment to every household to build a town-owned Gigabit fiber network that will pass every household in the community. A town-wide vote supported this funding approach. Put in perspective, the average cost of a large, single topping pizza in the U.S. is currently \$9 to \$12.

Two small cities in Utah are currently evaluating the potential of a \$10-12 utility tax levied on every household and business to finance a full fiber to the premises build out, including a modest "free" Internet service that would be adequate for email and light Web use. Most households will probably choose to select a higher performance Internet package from a private provider on the network. A \$5/month special assessment (the cost of one large pizza) on every household in Craig County could raise as much as \$2.6 Million for broadband over twenty years—enough to take Gigabit fiber to nearly every home and business.

The tables below shows the kind of funds that could be generated over several time periods. If ten dollars per month were collected from each household for thirty years, it would easily finance the immediate build out of Gigabit fiber that would pass nearly all homes and businesses in each county.

Individual Service District Examples								
Monthly Assessment			100 Homes Five Year	100 Homes Ten Year				
Amount			Assessment	Assessment				
\$5	\$15,000	\$30,000	\$30,000	\$60,000				
\$10	\$30,000	\$60,000	\$60,000	\$120,000				
\$25	\$75,000	\$150,000	\$150,000	\$300,000				
\$50	\$150,000	\$300,000	\$300,000	\$600,000				

A lesser amount (e.g. \$2/month over twenty years) would easily finance the immediate build out of a comprehensive wide area wireless tower network in each, as well as some fiber infrastructure.

Craig County Special Assessment Examples							
Monthly Assessment Amount	Twenty Year Assessment	Thirty Year Assessment					
Number of Households	2,219						
\$1	\$532,560	\$798,840					
\$2	\$1,065,120	\$1,597,680					
\$5	\$2,662,800	\$3,994,200					
\$10	\$5,325,600	\$7,988,400					

#### 10.15 PROPERTY TAX INCREASE

While raising taxes can be politically very difficult, a very small incremental increase in property taxes, with the increase clearly earmarked specifically designated for broadband development (.e.g. one-quarter cent) might be possible to sell to citizens and businesses.

The table below illustrates a hypothetical example of what funds might be raised for broadband improvements with a sample county-wide assessed property value.

	Sample Assessed property value	Broadband increment	Annual Broadband Fund	Ten Year Aggregate	Twenty Year Aggregate	Thirty Year Aggregate
1/4 of one cent	\$2,000,000,000	\$0.0025	\$45,000	\$450,000	\$900,000	\$1,350,000
1/2 of one cent	\$2,000,000,000	\$0.0050	\$90,000	\$900,000	\$1,800,000	\$2,700,000
1 cent	\$2,000,000,000	\$0.0100	\$180,000	\$1,800,000	\$3,600,000	\$5,400,000

## 9.16 GRANT APPLICATION ACTIVITIES

Activity	Description	Discussion	Tasks
Develop a grant application	The grant application process, from start to award announcement, can be nine to twelve months.	Broadband grant application requirements have become more stringent over time, with more grant agency oversight and review. Careful planning is essential to develop a successful application.	<ul> <li>Once a grant opportunity has been identified, review grant requirements to determine if the project can qualify. For example, some grants require two years of financial history.</li> <li>Identify regional agency that will assist</li> <li>Begin contacting potential ISP partners.</li> <li>If the project qualifies, identify at least two people to take the lead to prepare application.</li> <li>Prepare a task list of all grant materials requirements and identify data needed.</li> <li>Develop a timeline for developing sections of the grant.</li> <li>Identify requirements for letters of support and matching funds and develop timeline to solicit and collect commitments.</li> <li>Complete all sections of grant application with assistance from public and private partners.</li> <li>Submit grant application.</li> </ul>

Typical Timeline	Months											
Tasks	1	2	3	4	5	6	7	8	9	10	11	12
Determine grant qualifications												
Identify regional council partner												
Identify ISP or WISP partner if needed												
Appoint grant team												
Create grant task list												
Prepare timeline and assign tasks to partners												
Identify matching fund requirements and letters of support to solicit and collect as needed												
Complete all sections of the grant application												
Submit grant												
Grant agency review								_				
Awards announcement												

## 11 PARTNERSHIP OPPORTUNITIES

Because nearly all telecom infrastructure includes some use of public right of way, public/private partnerships are always a requirement for broadband infrastructure. Among Craig County and private entities like ISPs and WISPs, the more common synergies are:

- The need for more bandwidth,
- The need for more affordable bandwidth, and
- The need for more affordable bandwidth to be more widely available.

Potential project partners include:

#### ISPs and WISPs

Throughout the U.S., many WISPs are aggressively pursuing public-private partnerships (PPPs) with county governments. These partnerships may include a variety of strategies: collaboration on a grant opportunity, shared costs of developing a new tower site, revenue sharing, fee waivers, and other sorts of cost and revenue sharing. The advantage of this kind of PPP is that the WISP typically is responsible for most of the day-to-day management of the network assets.

The County can pursue public/private partnerships with technically qualified and financially stable ISPs and WISPs. Where appropriate, the County can channel grant funds to providers while will use the funds to build and manage new broadband infrastructure.

Selected providers should be able to show technical competency and have a demonstrable track record of managing substantial fiber and/or wireless builds on time and within budget. It will also be important for any public/private partnership agreement have a claw-back agreement. When public funds are transferred to a private company, the County should have the ability to "claw back" the built infrastructure for a minimum of five to ten years.

Conditions for a claw back could include bankruptcy of the ISP, sale to a third party (where substantial profit taking leverages the public funds), poor service, unreasonably high cost of service, and/or poor service reliability.

#### **Public Safety**

The Sheriffs department, fire, and rescue departments all need better access to broadband and improved wireless voice/data communications. Throughout the United States, public safety voice and data communications systems are being upgraded, often at staggering cost. Many of the upgrades include new towers to eliminate "holes" in the served area where first responder, fire, and rescue radios do not work. Combining public safety needs with community broadband needs can bring new sources of funding and cut costs, sometimes dramatically. Elected officials may need to take the lead in this area to ensure that public safety officials work collaboratively with the broadband efforts.

The availability of public-safety towers and/or new towers can enable new services and applications for police, fire, and rescue in Craig County. Secure WiFi hotspots can be set up around and near the towers, so that reports can be filed from the field using the WiFi Internet connection. Other communities that have done this have found that it saves time and keeps patrol cars out in the field longer.

There are often grants available for public-safety voice and data communications improvements, like new towers and upgrades to existing tower facilities, that could also support the broadband initiative. Any public-safety tower or communications expenditure should be analyzed to determine if the expenditure can also support expanded broadband access in the county.

#### K12 Schools

Craig County schools have adequate broadband service at existing school locations. But K12 students often lack adequate Internet service at home, and some schools are careful not to assign homework that requires Internet access. Parents consistently report on the burden of having to drive children to a public library or some other WiFi hotspot to get Internet access for school work. The County should work with the schools to apply for education grant funds to achieve this goal, and to keep K12 parents informed about broadband activities.

#### **County Businesses**

Businesses in the county and the local Chamber of Commerce chapters have an important role to play as advocates for the broadband work of the County. At both the county and state level, businesses that need more affordable and better broadband should ensure that elected officials understand the urgency. The County, as part of its broadband awareness efforts, should ensure that local businesses are kept up to date with work activities, grants, and other efforts (e.g. attend CoC meetings at least quarterly to report on the work of the County).

#### **Electric Utilities**

Electric utilities are natural partners in any county broadband venture. Electric utilities own utility poles, bucket trucks, and the equipment needed to install aerial fiber. Chattanooga's fiber to the premises (FTTx) initiative has enabled millions in savings for the city-owned electric service. When power outages occurs from events like ice storms or tree damage, the utility is able to use the fiber network to very accurately pinpoint where the outage occurs, enabling a more rapid repair of the electric network at less cost.

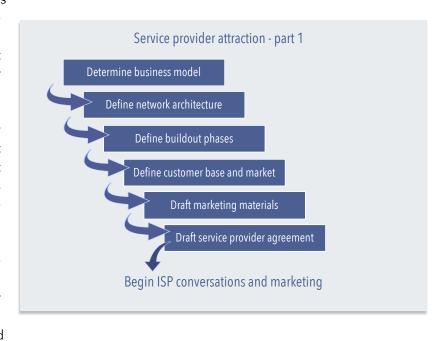
The County should continue to meet Craig-Botetourt Electric to assess their interest in broadband projects, especially in the planned fiber to the home project in New Castle.

# 12 WORKING WITH INTERNET PROVIDERS AND PARTNERS

Throughout the U.S., many WISPs are aggressively pursuing public-private partnerships (PPPs) with county governments. These partnerships may include a variety of strategies: collaboration on a grant opportunity, shared costs of developing a new tower site, revenue sharing, fee waivers, and other sorts of cost and revenue sharing. The advantage of this kind of PPP is that the WISP typically is responsible for most of the day-to-day management of the network assets. County and local government investments are typically limited to passive assets like towers and site maintenance that requires no day to day responsibility and only occasional site and tower maintenance.

#### 12.1 ATTRACTING PROVIDERS TO THE NETWORK

The WISP business is challenging. Setting the high cost of towers aside, a WISP placing equipment on a newly available tower must engage in a significant marketing and sales effort to identify customers who want service. Because most broadband wireless frequencies, including the new LTE frequencies, require or work best with line of sight between the customer and the tower, the WISP, even after identifying a potential customer, must often send



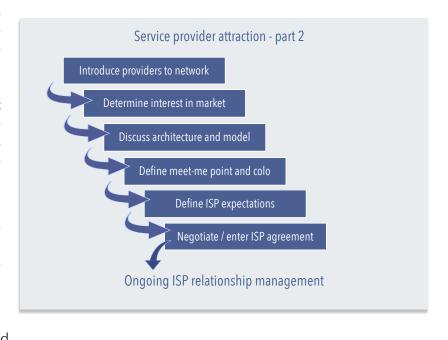
a technician to the prospective customer location to determine if line of sight or near line of sight is available. It is common that a low hill, a building, trees, or other vegetation will degrade or block the signal.

If line of sight or near line of sight is available at the customer location, a second visit to install the customer antenna may be required before the customer can receive service. At this point, the WISP may have spent several hundred dollars on the acquisition of a single customer, and it can take many months of service before the WISP will even break even.

The cost of tower access be one of the most expensive parts of offering wireless Internet service. If a WISP has capital funds, it must choose where to place towers and smaller poles very carefully, and few WISPs have the capital to build enough towers to cover an entire county.

Just as government builds roads to enable commerce and services offered by the private sector, local government can also build towers to enable Internet services. Space on those towers is offered to WISPs for modest fees with the goal of expanding and improving Internet access.

Historically, tower space lease fees have been high, because early lessees were cellular companies offering high-margin cellphone and data services. Vertical space on a county-owned



tower or water tank often range between \$1200 and \$2500 per month. But the business margins on fixed point wireless Internet are much lower, and tower lease fees should be set at levels that allow WISPs to make a business case to spend the additional capital for radios and related equipment on a new tower.

Activity	Description	Tasks
Attract Internet Service Providers (ISPs, WISPs)	One or more service providers will be needed to lease poles, and/or manage the network, and to partner for grant funds.	<ul> <li>Once owners/stakeholders have approved the plan, contact local and regional ISPs to assess partnership interest.</li> <li>Schedule individual meetings with the ISPs to present project goals and objectives.</li> <li>Assess interest of the companies in public-private partnership.</li> <li>If interest is positive, reach agreement on which grant opportunities to pursue jointly and in what area.</li> <li>Develop an MOU (Memo of Understanding) that identifies what tasks the WISP will perform for grant application and what project will perform.</li> </ul>

Typical Timeline		Months											
Tasks		Mon 2	Mon 3	Mon 4	Mon 5	Mon 6	Mon 7	Mon 8	Mon 9	Mon 10	Mon 11	Mon 12	
Contact ISPs and WISPs													
Schedule individual meetings													
Assess interest in partnerships													
Schedule meetings to discuss grant opportunities													
Develop MOUs as needed for grants that will be pursued jointly													

#### 12.2 TOWER MANAGEMENT

A modest application fee, for example \$200, for tower access should be nominal for WISPs; high application fees discourage WISPs from evaluating new tower opportunities.

Revenue sharing arrangements, where WISPs pay as they acquire customers, instead of a fixed lease fee are more difficult to manage. While the argument for revenue sharing seems to make sense, in practice, it requires the tower owner to have access to the accounting and financial records of the business, which can be challenging to enforce. It is also a financial disincentive for the WISP, as the fees that they have to pay for tower access continue to increase without end. The following is suggested:

- Use a single public fee schedule for all providers.
- Use a single tower space agreement for all providers.
- Tower access should be made available in ten foot vertical segments or on a per attachment basis, as high as possible on the tower without interfering with other uses, such as public safety antennas. Note that it is unlikely that any tower will have more than two providers on it.
- If a WISP is applying for space on an existing tower, no certified engineering plans should be required, but if a structural analysis is needed to determine wind and tower loading will not exceed tower specifications, the tower owner may have the WISP bear some or all of the cost of that study. Note that there appears to be high variability in the cost of these studies, and the tower owner should be careful to keep the structural analysis costs as low as possible.
- For a typical tower, identify two 10 ft spaces (where space is available) on existing towers and designate/reserve those for WISP use. The spaces should be as high as possible on each tower without interfering with other local government and public safety use. The lease cost of the lower space should be at least 20% less than the higher space. Tell WISPs exactly what space is available at each tower and at what heights; this makes it easier for WISPs to evaluate the potential market that could be served from each tower.
- If an existing shelter is available at the base of a tower and rack space for WISP equipment is available within that shelter, electric power should simply be provided as part of a very

modest lease fee for rack space. If there is no space available in the shelter (e.g. lack of space or dedicated for public safety use), then the WISP should install an H-frame and have their own electric meter installed in an area designated at the base of the tower.



- Leases should be a minimum of two years and should auto-renew if the ISP is meeting performance requirements.
- It may be more effective to have a single lease agreement with access to all towers, and the contract should require the ISP to put equipment on all towers within a certain period of time (e.g. nine to twelve months). This limits ISPs from cherry picking towers with more potential customers and ignoring towers in parts of the service area with lower population density.
- Monthly tower lease fees should be on the order of \$200 to \$250 per tower or an equivalent per-attachment fee (e.g. \$50-\$75 per attachment). Higher fees make it difficult for providers to make a business case for the cost of equipment and the extensive marketing required to develop a customer base around a tower.
- Consider offering an initial grace period on fees of three to six months, and/or offer a one-year sliding scale of fees. An example sliding scale would waive the fee for the first 3 months, charge 25% of the fee for the next 3 months, up until 12 have passed and the full fee is assessed. There are many ways to structure the initial fee period, but it is important to recognize that the WISPs incur substantial early costs to develop revenue and customers for a new tower.
- All tower leases should expire on the same date even if started at different times. This allows
  the tower owner to potentially make a smoother transition to a new provider if there are
  issues, and will give them more leverage and control over the service.

- In contracts, fee reductions should be worded as discounts that can be revoked if performance requirements are not adequately being met.
- Describe what is available for ground space, such as space for WISP cabinets, shelters, and H-frames for electric service, shared generators that may be provided. Also indicate what the WISP has to provide at the base of the tower. If new shelters will be allowed, set minimum standards for new shelters.

#### 12.3 WORKING WITH INFRASTRUCTURE LEASES

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

#### Tower Lease Considerations

- There should be a single public fee schedule for all providers that want to lease space on the tower.
- There should be a single tower space agreement that is used for all providers.
- Tower access should be made available in ten foot vertical segments, as high as possible on the tower without interfering with other uses (e.g. public safety antennas). Note that it is unlikely that any tower will have more than two providers on it.
- Leases should be a minimum of two years and should auto-renew if the ISP is meeting performance requirements.
- It may be more effective to have a single lease agreement with access to all towers, and the contract should require the ISP to put equipment on all towers within a certain period of time (e.g. nine to twelve months). This limits ISPs from "cherry picking" towers with more potential customers and ignoring towers in parts of the county with lower population density.
- Monthly tower lease fees should be on the order of \$200 to \$250 per tower. Higher fees make it difficult for providers to make a business case for the cost of equipment and the extensive marketing required to develop a customer base around a tower.
- For a typical tower, identify two (2) ten foot spaces (where space is available) on existing towers and designate/reserve those for WISP use. The spaces should be as high as possible on each tower without interfering with other local government and public safety use. The lease cost of the lower space should be at least 20% less than the higher space. Tell WISPs exactly what space is available at each tower and at what heights; this makes it easier for WISPs to evaluate the potential market that could be served from each tower.
- An initial grace period of three to six month should be offered on fees, and/or offer a one year sliding scale of fees (e.g. first three months, fee waived; months four to six, 25% of normal fee; months seven to nine, 50% of normal fee; months ten to twelve, 75% of normal fee). There are many ways to structure the initial fee period, but it is important to recognize that the WISPs incur substantial early costs to develop revenue and customers for a new tower.
- All tower leases should expire on the same date even if started at different times. This allows the enterprise to potentially make a smoother transition to a new provider if there are performance issues, and will give the project entity (e.g. County government, Craig County Development Association) more leverage and control over the WISPs.

- Leases should be a minimum of two years and should auto-renew if the ISP is meeting performance requirements.
- In contracts, fee reductions should be worded as discounts that can be revoked if performance requirements are not adequately being met.
- There are considerations for ground-space (e.g. WISP cabinets, shelters, H-frames for electric service) that will have to be evaluated at each tower site. If new shelters will be allowed, the ownership entity should set minimum standards for new shelters.

#### Dark Fiber Lease Considerations

Passive fiber infrastructure (i.e. no electronics) can include conduit, fiber cable, splice closures, and cabinets. Because all powered network equipment would be provided by the lessee (i.e. the ISP), there is no day to day management responsibilities and only occasional routine maintenance. Emergency break-fix for situations like a cable broken by a construction firm working in the right of way can be outsourced to a qualified private sector provider. Local governments routinely manage much more complex water and sewer systems. Some guidelines for leasing dark fiber include:

- There should be a single public price list for the cost of leasing fiber strands.
- A standard master agreement should be used for leases. This agreement will typically require an SLA (Service Level Agreement) that specifies repair times for emergency break-fix (i.e. the fiber cable has been damaged and a qualified break-fix repair firm must be on call to make repairs).
- It will also be important to have IRU pricing (Indefeasible Right of Use). Fiber strand leases are typically for periods of ten years or less. IRUs are long term leases and are typically twenty to thirty years in length. IRU fees have two parts: a single upfront payment that usually reflects some portion of the construction cost for the fiber route. As an example, if a lease will include twelve strands of fiber on a ten mile route of 144 strand fiber that cost \$100,000 to construct, the one time fee might be 12/144 \* \$100,000 = \$8,333. Most IRUs also have a modest annual maintenance fee that reflects the cost of maintenance and repairs; this would also be pro-rated to reflect the number of fibers assigned to the IRU agreement.
- Splice points and who is allowed to open handholes to perform splicing must be identified in the master agreement.

### 12.4 PREPARING FOR TOWER EXPANSION

### Activities Preparing for Tower Expansion

ACTIVITY	DESCRIPTION	DISCUSSION	TASKS					
Draft tower site lease agreement	Tower site lease agreements between the property owner and the broadband entity will be needed.	The county attorney may be able to provide most or all of the legal agreements needed.	<ul> <li>Establish a basic tower lease agreement that will be used with all providers.</li> <li>Identify legal counsel who will provide a draft agreement.</li> <li>Circulate draft agreement</li> </ul>					
			for comments.  • Approve lease agreement for use.					
Identify prospective tower sites	New towers will be needed in the county. The broadband plan identifies the general area where towers will be needed and most effective, but specific tower locations will have to be identified with the assistance of residents in the area and property owners. This will be an ongoing activity for at least the first year.	Height above the surrounding terrain, proximity to roads, and proximity to electric service are factors that have to be evaluated.	<ul> <li>Review broadband plan and prepare a list of sites to survey.</li> <li>Determine road access and electric service. Closer is better.</li> <li>Meet with property owner to discuss a potential lease.</li> <li>If site owner is agreeable, add site to list of grant-ready tower sites.</li> </ul>					
Identify prospective community pole sites	Many community poles will be needed to provide the maximum amount of wireless broadband availability.	Community poles should only be placed where there is a cluster of nearby residents who are prepared to purchase Internet service from the provider on the pole.	<ul> <li>For each area in a build out phase, identify clusters of typically 12-25 homes.</li> <li>Identify a local champion willing to talk to neighbors and assess demand.</li> <li>If demand meets target, add to list for next grant application with community poles.</li> </ul>					

### Timeline Preparing for Tower Expansion

TASKS	Mon 1	Mon 2	Mon 3	Mon 4	Mon 5	Mon 6	Mon 7	Mon 8	Mon 9	Mon 10	Mon 11	Mon 12
Obtain agreement on using a standard lease for all towers												
Identify legal counsel to draft agreement												
Circulate draft agreement for comment												
Obtain approval for site lease agreement												
Develop list of potential tower sites												
Assess road, electric service access												
Meet with property owners												
Add agreeable owners to prospective tower list												
Identify clusters of residents for community poles												
Identify a local champion to assess demand												
Add clusters that meet demand to prospect list for community poles												

## APPENDIX A: GLOSSARY

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

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

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

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

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

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

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

Fiber Optic Splice Closure: See FOSC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## APPENDIX B: RESIDENTIAL SURVEY OTHER COMMENTS

Residential survey responses from Question 24: Any Additional Comments

- I work away from home but husband has home business and uses internet daily to order parts etc.
- We live on Route 606 (Caldwell Mountain Road). We can see the fiber optic lines at the beginning of our road on either side. It's SO close but yet we don't have it. Even though our road is not highly populated like other areas of the county, it doesn't negate our need. It's just like electricity was back in the 1930s it's no longer a luxury to have internet service it's a necessity.
- Something needs to be done to get better internet service to Craig County as a whole and not just for those in town. Covid has forced me to work from home and with download speeds less than 5 mbs, I can't get the updates I need on my laptop because TDS is a terrible provider.
- T-mobile was suggested to us and we tried to sign up for this, but even living right in town it's not available to us. It would be nice to have more options, but so far TDS has done okay.
- I live in town now, where there is an option for good Internet. However, I lived outside of the town for many years on RT 621, internet was awful there. I worked from home and had to get US cellular to provide my internet which was costly and had a data usage cap.
- We need better quality internet with better speeds
- Seriously need extended fiber internet (preferable) to our area, which is more reliable and less susceptible to weather.
- TDS DSL sucks and is very expensive.
- Better cellular service. Wether it's is cellular or Verizon. Verizon works better in town but does not work outside of town. Us cellular half works all the time.
- I am a fire fighter wife and better access for our firehouse and firefighter would be a great help for them and personal use at home
- We have been without home internet now for a month. It just became too much for a single father with three children as it is to many in our community, to afford. \$94 a month just for internet that barely hits 19mbps download at its best on a low traffic day is simply extortion from a greedy company running a monopoly on a small urban community while providing low-tech, sub-par service.
- Internet speed less than 1-2 Mbps. Very unstable frequency unavailable.
- We are a highly connected technology focused family and would really like to get Fiber to the new house.
- I spent a few years in Iraq from 2003 to 2006 and we had better internet over there almost 20 years ago than I have at my house, it is barely better than dial up, but I still have to pay over \$100 a month for it
- I would like faster internet service because the one I have right now is so slow.
- The new federal program should subsidize it.

- Both internet and cell service options are limited in this county. There are locations where even US Cellular does not provide a signal. Bad weather has an impact on our DISH TV and internet options are costly. We just got TDS internet service but are required to have a landline that we do not use as it is only set up for local and 800 number calls, all others have an additional charge. The cost to get this set up in our home exceeded \$200! We are being held hostage to the internet provider due to our choice to live in this beautiful county. I feel sorry for all who have children that rely n the internet for schooling. Thanks for asking and we hope that Craig County can get moved into the current technological age!
- Fiber is the only way to go. It has zero error rates, unlimited bandwidth is easily expandable, and isn't weather dependent. I am stuck with TDS, have tried Cellular services but was very unreliable and had terrible error rates, also most Cell providers throttle data limits.
- Need better access to cellular services (we live in a dead zone). Also would be nice to have more options to choose from different carriers for cellular and internet services (i.e. more than one carrier to choose from).
- Assess to more affordable and accessible broadband is vital for rural areas, enabling modern
  communications for local government, schools, employees at work or home, businesses and
  entrepreneurs, healthcare, families, and those in agriculture the number one industry in Craig
  County. Rural broadband should be compared to the success of rural electrification, it made
  significant transformation for communities. Local government should assist in the same way,
  providing broadband service that can transform the community with connectivity now essential
  to stay on America's digital superhighway.
- my wife works from home Monday-Friday. Our internet is used wisely to allow enough data for her to work from home. Hopefully in the near future we can have better internet that will allow us to live stream movies and not worry about data caps.
- To attract more young families to the county we need better internet service for at home and remote working. I would strive to work from home more if I had better internet and cellular service. Verizon is not reliable in our home wirelessly during the summer as the foliage seems to be slowing down the connection for cell phones.
- TDS was our previous ISP, we paid for service that we never received despite multiple tickets to fix it our service was never reliable for the 70 dollars a month we were paying for it. We switched to a cheap Verizon hotspot which is spotty at best but at least we get what we pay for. Often use our phones as hotspots instead because we have more for whatever reason higher speed on a hotspot phone than the actual device even though they are both on Verizon. Shown interest and paid deposit for Starlink but haven't heard anything yet.
- We will be going to Starlink once we know it is available in our area.
- The Commonwealth of Virginia was 'given' a huge sum of money through Federal COVID legislation that the governor said would be used to expand broadband internet throughout the state. Craig is definitely in need of an internet upgrade and there seems to be plenty of money available that shouldn't cost the County's taxpayers. US Cellular has no interest in dropping their limits and caps!!! Competition is desperately needed.
- This is a much needed improvement for Craig County!
- People in the more rural section of our already very rural county need to have some decent internet. When your upload speed is .8 things are bad. We pay for 15 upload and don't get that, but the next package down only goes up to 10 I believe. That is just not acceptable but we have

no choice. They have been saying for years that TDS was installing fiber and supposedly it's in our lines now but not connected. Regardless, we need to move into the 21st Century like most all of America has already done. I believe the only reason TDS has done anything is because they have been forced to by our govt. That's bad when a company has to be forced to take care of their customers.

- we are just lucky that TDS provides good speed in our area but out in the reaches of the county internet speed must be very poor so I support better broadband for the county as a whole.
- Sometimes we can't watch TV programs on Sling because of the buffering every few seconds. Sometimes all of our internet devices stop at the same time saying no service and then come back on in 30 seconds or so. I currently have a backup internet connection with a hotspot through our cellular provider in case TDS goes down or the power goes out because I work from home about 10 hours a day and also have weekend hours from home so I cannot be without internet ever. Our past experience with satellite internet was not positive so reliable local internet is extremely important to us.
- there are some days the internet is not even connecting with no storms or anything
- I have Hughes net ,about my only choice other than the internet, it was so slowest of the times I couldn't even connect I was last one on the line.
- QUESTION #23 I lived in the Town of New Castle for 13 years and in this county location for 48 years a total of 61 years to observe our local government. During these years the county government has not been able to follow thru on any long term project. The motivation is just not there for people serving limited terms nor do they educate themselves in funding sources. What is Craig-Botetourt doing in this line? My internet service is much better than my neighbor's just a few miles up the road-I am close to a cabinet if that makes the difference. I am all for improvement as long as you don't damage what we already have! I really don't think Craig-Botetourt should be getting into the foray, but I understand they have access to funds to improve rural service.
- Faster internet service would be a great benefit to the grow as a community.
- Previously had hugesnet satellite internet, was very unreliable, it was also quoted at 15meg we barely got 3meg on a clear day. We now have TDS dsl internet very reliable but only 5 to 6meg barely enough to stream tv and very slow for remote working. Additionally we have virtually no cell service with US cellular inside our home, we have to go outside to make a call or send a text. A typical reading on my Samsung S9 is -100dBm outside.
- We feel like TDS takes us for granted
- Facilitate, yes. Control, no.
- I have two homes in Craig County, and have completed this survey for both.
- With TDS and my location, I am forced to pay for landline phone service which I do not need. I
  use US Cellular for phone service. This adds an additional \$20 per month to the internet bill.
  There is no other option at my location in Craig County. BTW, the phone line are in very poor
  condition. Regularly, I must call for service due to line issues caused by aging and weather.
- Every time it thunders the internet goes out which has been a lot recently
- I am retired but would operate a home based business if I had access to reliable, fast internet service. Further, our daughter lives here. She is a medical professional and can work from home

some of the time, if we had decent internet. This has been more of a problem for her during the COVID pandemic.

- I'm in a contract here. Moved in 6/16/2021
- I am extremely dissatisfied with my current internet service and provider at this address. When I call to discuss the poor service they try to convince me that what they are providing is great. I have another residence and my internet service is extremely better (100+ Mbps) and I'm paying the same price. It's ridiculous that I am not getting similar service in Craig County.
- We are behind times with internet accessibility and need to have an option that is faster and cost effective. Right now we pay good money for poor service.
- so far as we know, TDS is the only provider for our address
- Tds telecom is a horrible provider.
- You team does wonders for this county
- Please its 2021 we need better internet in Craig the entire county not just New Castle. People would choose a better option if it was available
- I have to use my home wifi to have cellular phone service at my residence.
- I would love to have a decent internet source that can give 25 mbps consistently so my family can do multiple things at a time without worrying about lag, or loading issues.
- Our household includes two professionals who need/needed high speed internet to work from home during the COVID pandemic. Our bandwidth has not been good enough for both of us to simultaneously work from home and do home schooling. We would greatly benefit from better internet service.
- County government should aggressively seek state/federal funds to bring broadband service to all county residents who want it.
- Most definitely! The internet service is slow allot of the time or does not work. I also have to reboot the Wifi router to get it to work, almost daily. I pay all of my bills and do banking online. We do not have enough internet to use Hulu and Netflix (it keeps regenerating). My elementary schoolchild also really needs the internet to do schoolwork and research. Thank you!
- We love living in rural America but in this area we are handicapped by poor internet and phone service. TDS is too expensive and a poor provider but it is the only provider available in this area. We are a captive audience!
- Would like more affordable internet service.
- We need better cellular service in Craig County. I have Verizon and it has limited range in New Castle, and no range outside of the town of New Castle. U.S. Cellular is better, but there are still areas in Craig where service in unavailable even with U.S. Cellular. This should not be an issue in this digital age we now live in.
- TDS Telecom needs to work on their landline and not blame their inability to troubleshoot on outside influences. The lines are outdated and in poor shape, spliced everywhere, you call customer service, they make you jump thru hoops and still gets you nowhere. I have complained for years about my land line opening up when nobody in the household is using it. They cannot explain why. Very Very dissatisfied with TDS Telecom
- I feel that we have needed competition for the telephone and internet services for years.
- We also live in a dead zone for cell phone service...

- I have a broadband cable running across my property but private citizens are not presently allowed to connect.
- There is fiber 150' from my house, NOT allowed to connect.
- Would love better internet & cell service.
- I also use my computer for church functions.
- I go 1 minute to 3 days without internet multiple times a year!
- We all need internet access for civic engagement, lifelong learning, and school.
- Cost will have a direct impact on my upgrading.
- Cell service is terrible. Calls drop or we have no service.
- Would like internet only.
- Work on the cellular 'dead zones' in this town.