APPALACHIAN POWER℠

An AEP Company

BOUNDLESS ENERGY™

Broadband Feasibility Study

Submitted to the

West Virginia Broadband Enhancement Council

October 22, 2019

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Submitted to the West Virginia Broadband Enhancement Council
by Appalachian Power Company and Wheeling Power Company
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COME NOW Appalachian Power Company (APCo) and Wheeling Power Company (WPCo) (collectively the Companies) and hereby submit this Broadband Feasibility Study (Study) to the Broadband Enhancement Council (Council) pursuant to W. Va. Code § 31G-4-5 (b). In support of this filing, the Companies state as follows:

I. Introduction

APCo and WPCo are electric utilities operating within West Virginia and are regulated by the Public Service Commission of West Virginia (Commission). For many years, the Commission has approved uniform rates for the Companies.

This Study has a number of purposes. Its primary purpose is to investigate the feasibility of constructing and operating a middle-mile broadband infrastructure project[1] within APCO's West Virginia service territory, and to seek a determination from the Council of the feasibility of the project. W. Va. Code § 31G-4-5 (b) and (e).

[1]Middle-mile refers to the back-bone infrastructure connecting an Internet service provider's (ISP) last-mile service network to the global Internet. The middle-mile is analogous to a highway, with the last-mile being the side roads.

An additional purpose of the Study is to recommend "next steps" that will need to be completed to allow the proposed project, if approved by the Council, to move forward.[2] As envisioned by W. Va. Code § 31G-4-5, those next steps include, among other things, the resolution of legal and regulatory barriers, perhaps through the development and passage of legislation; considerations regarding how the Council should identify one or more last mile broadband Internet providers that may lease middle-mile broadband Internet capacity to be installed under the proposed project; and suggestions regarding the specific lease terms and conditions, to be set by the Council, under which ISPs would lease middle-mile broadband capacity from APCo.

The West Virginia Legislature (Legislature) made a number of findings when it enacted Chapter 31G of the West Virginia Code. Among those findings were the following:

- The lack of affordable, accessible broadband service in the underserved and unserved areas in this state necessitates consideration of alternative means and methods of providing Internet services (W. Va. Code § 31G-2-3 (a) (2));
- Although broadband access has been extended to many of West Virginia's cities, towns and other concentrated population areas, some areas of the state, mostly rural, remain unserved (W. Va. Code § 31G-1-1 (2)); and
- It is a primary goal of the Governor, the Legislature, and the citizens of this state, by the year 2020, to make every municipality, community, and rural area in this state, border-to-border, accessible to Internet communications through the expansion, extension and general availability of broadband services and technology (W. Va. Code § 31G-1-1 (1)).

[2] The Companies recognize that the Council issued a Request-for-Information on October 2, 2019 (RFI). They look forward to working with the Council and others to advance middle-mile broadband infrastructure in West Virginia in a timely and orderly manner.

Based upon these findings, the Legislature has declared that one of its purposes is to provide for the development of policies, plans, processes, and procedures to be employed and dedicated to extending broadband access to West Virginians, and to their families, by removing restraint on the development of those services and for encouraging and facilitating the construction of the necessary infrastructure to meet their needs and demands. W. Va. Code § 31G-1-1 (5). To this end, the Legislature created the Council to explore any and all ways to expand access to broadband services, including, but not limited to, middle mile, last mile, and wireless applications. W. Va. Code § 31G-1-3 (a) and (h) (i) (a) (1). The Council is authorized to receive, and render a determination on, feasibility studies, such as this one, proposing a middle-mile broadband infrastructure expansion project to be constructed and operated by an electric utility within its West Virginia service territory.

The Legislature has also adopted a specific definition of broadband or broadband service, as follows:

> "Broadband" or "broadband service" means any service providing advanced telecommunications capability with the same downstream data rate and upstream data rate as is specified by the Federal Communications Commission and that does not require the end-user to dial up a connection, that has the capacity to always be on, and for which the transmission speeds are based on regular available bandwidth rates, not sporadic or burstable rates, with latency suitable for real-time applications and services such as voice-over Internet protocol and video conferencing, and with monthly usage capacity reasonably comparable to that of residential terrestrial fixed broadband offerings in urban areas: Provided, That as the Federal Communications Commission updates the downstream data rate and the upstream data rate the council will publish the revised data rates in the State Register within sixty days of the federal update. W. Va. Code § 31G-1-2 (1).

The use of the phrase "with monthly usage capacity reasonably comparable to that of residential terrestrial fixed broadband offerings in urban areas" in this definition, coupled with the requirement that any Study submitted to the Council by an electric utility, pursuant to W. Va. Code § 31G-4-5 (b), shall include "[t]he method of attachment and connection of the middle-mile broadband fiber assets to the electric utility's distribution infrastructure (emphasis added; see W. Va. Code § 31G-4-

5 (d) (1) (D)), indicates the Legislature's clear intention that any middle–mile broadband infrastructure expansion project proposed by an electric utility under W. Va. Code § 31G-4-5 (b) should be based upon fiber optic cable. This is consistent with the Federal Communications Commission's (FCC) conclusion that "mobile services are not currently full substitutes for fixed service."[3] The 2019 FCC performance benchmark for fixed terrestrial-based broadband speed is 25 megabits per second (Mbps) download and 3 Mbps upload.[4] Given these considerations, in this Study, the term broadband refers to the current FCC definition of 25 Mbps download and 3 Mbps upload speeds using a fiber optic cable as the middle-mile broadband infrastructure.[5]

Regulated electric utilities, such as the Companies, are uniquely positioned to play a key role in the expansion of middle-mile broadband infrastructure into rural West Virginia. To begin with, they already have a distribution infrastructure (consisting of poles and wires) in place that is used to provide electric service to their rural customers (distribution system). In the case of the Companies, they also have over 30 years of experience deploying fiber optic cable for use as an internal communications system within their service territories.[6] While additional fiber optic cable is currently being deployed to provide more robust communications and greater connectively to transmission substations and other

[3] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely* Fashion, GN Docket No. 18-238, 2019 Broadband Deployment Report, Section III. A.11. Defining Advanced Telecommunications Capability FCC 19-44 (May 29, 2019).

[4] Id. Section III. A.12.

[5] This is consistent with Section 4.1 of the Council's RFI.

[6] Throughout this study, the Companies refer to fiber optic cable as a communications system or platform. Those phrases are intended to cover a broad range of critical connectivity needs of the Companies, including, but not limited to, such things as Supervisory Control and Data Acquisition (SCADA), protective relaying, security, communications to and from transmission and distribution centers, and inter-facility voice, data and video communications.

transmission assets, it could be extended into rural areas of West Virginia by attaching fiber optic cable along some portions of the Companies' distribution system. Because Section 235 of the National Electrical Safety Code (NESC) permits electric utilities to connect fiber optic cable used for their communication needs in the "power supply zone," electric utilities can cost-effectively and efficiently install such fiber optic cable.[7] Given these facts, the Companies have the required capability to manage both the costs and complexity of constructing and operating the proposed middle-mile broadband infrastructure expansion project in APCo's West Virginia service territory.

It is also in the public interest to encourage the installation of fiber optic cable on the Companies' distribution systems. The Legislature has already determined that extending broadband Internet service into rural West Virginia is in the public interest, and encouraging electric utilities like the Companies to install fiber optic cable along portions of their distribution system would provide the middle-mile infrastructure necessary to reach this goal.

In addition, the Companies have embarked upon a program of distribution grid modernization designed to improve the reliability of their West Virginia customers' electric service. It is possible to modernize the distribution grid currently without the use of a fiber optic cable communications system. While such a system would be more costly than other available options, it would provide a more robust, secure and "future-proof" (i.e. longer lasting)[8] communications system. Finally, the combination of

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[7] Only electric utilities are permitted to install fiber optic cable for communication purposes 12 inches below the distribution neutral in the "power supply zone" or "supply space;" other attachers frequently face higher installation costs because, for safety reasons, they are required to install cable in the "communications space" below the power supply zone, which may result in the need to replace more existing poles with taller ones to obtain the needed height. (see Exhibit 1).

[8] Unlike a wireless or radio frequency (RF) mesh communications system, which would likely need to be updated at least three times over a 30 year period, fiber optic cable has an expected 30-year life and, because it transmits data more securely by converting electric signals into light, it will be able to serve as a robust communications platform for grid modernization initiatives, and middle-mile Internet service, over a number of years, even as technology evolves over time. The wireless technologies that the Companies currently use to deploy grid modernization projects are not capable of providing broadband communications, and, by their very nature, do not provide the same level of cyber-security as fiber optic cable.

highspeed Internet and improved electric reliability in rural areas of the Companies' service territories would provide the opportunity for increased economic development in those areas. West Virginia, its communities, and its citizens have suffered from the impacts of job loss and economic upheaval over a number of years, and it is in the public interest to encourage economic development to help restore jobs and improve opportunities for West Virginians. Bringing broadband Internet service, in combination with improved electric reliability to rural West Virginia, would improve opportunities for economic development and entrepreneurial ventures. Because economic development tends to increase electric usage, any increase in load would allow the Commission to spread the Companies' fixed costs, which are necessary to provide, maintain and improve electric service, over more units, thereby potentially reducing customer rates, or at least limiting future rate increases.

While there are significant and sound public interest reasons for the Companies to construct and operate middle-mile broadband infrastructure projects, such as the one proposed in this Study, there are potential regulatory and legal barriers that need to be addressed before such projects can proceed in West Virginia. The most important barrier involves reasonable assurance of cost recovery, given not only that the installation of fiber optic cable on the Companies' distribution system is not the lowest cost option for grid modernization initiatives in their service territories at this time, but also that it would require the installation of more fiber optic cable than would be utilized solely for the Companies' own communication needs. This presents a broad policy question because the deployment of fiber optic cable in the rural areas of the Companies' service territories, although consistent with West Virginia's goal of extending broadband into unserved areas of the State and beneficial with regard to the Companies' internal communication needs, would be more aggressive than currently planned.

Section II. of this Study describes the Companies' initial middle-mile broadband infrastructure expansion project, proposed to be constructed in two counties of APCo's West Virginia service territory, and evaluates that project in accordance with the provisions of W. Va. Code § 31G-4-5 (d). As required

by W. Va. Code § 31G-4-5(d) (2), Section II. D. of this Study discusses the regulatory and legal barriers to this initial project and future projects, and makes suggestions, including possible legislation, that would address such barriers so that the Companies' initial proposed project, and future projects, can move forward. Given the Council's responsibilities under W. Va. Code § 31G-4-5(f), Section III. of this Study sets out the following: the Companies' thoughts regarding how the Council should identify one or more last-mile broadband Internet service providers, sometimes referred to as ISPs, and perhaps other potential users of the middle-mile broadband infrastructure that APCo proposes to construct and operate as part of the initial project; and their suggestions regarding lease terms and conditions to be set by the Council, as part of its consideration of the feasibility of the proposed project. In the attached Appendix, the Companies provide additional background information and context for this filing.

While the Companies are requesting that the Council render a decision on the feasibility of their initial proposed project within the statutorily required 60-day period (W. Va. Code § 31G-4-5 (g)), it should be recognized that the proposed project will not be able to move forward until certain legal and regulatory barriers are resolved; one or more ISPs, which may lease the middle-mile broadband Internet capacity to be created by the proposed project, have been identified by the Council; APCo has had an opportunity to work with those entities to refine the parameters of the proposed project; and lease terms and conditions, including the level of lease payments and maintenance fees to be paid by such entities to APCo, have been established by the Council.

II. Proposed Project

Pursuant to W. Va. Code § 31G-4-5 (b), the Companies are proposing a middle-mile broadband infrastructure expansion project in two adjacent counties in West Virginia, Mingo and Logan Counties, which are within APCo's West Virginia electric service territory. As required by W. Va. Code § 31G-4-5 (d), this section of the Companies' Study provides an evaluation of the following:

(1) The scope of the proposed project for which the feasibility study is conducted, which shall include, but not be limited to:
(A) The route of the middle-mile infrastructure proposed for the project, the number of fiber strands that would be utilized in connection with the proposed project and dedicated to serve as the middle-mile, the location of the electric utility's distribution infrastructure that will be utilized in connection with the proposed project, the capacity of the middle-mile broadband infrastructure that will be available to lease to last-mile broadband Internet providers upon completion of the proposed project.
(B) The estimated costs of the proposed project, including but not limited to engineering costs, construction costs, permitting costs, materials and labor, right-of-way costs and a reasonable rate of return to the electric utility.
(C) The proposed schedule of construction of the proposed project; and
(D) The method of attachment and connection of the middle-mile broadband fiber assets to the electric utility's distribution infrastructure;
(2) The regulatory and legal barriers to an electric utility to make improvement to the distribution grid in furtherance of providing such middle-mile broadband Internet services in conjunction with its program of electric distribution projects;
(3) Whether it is in the public interest and the interest of the electric utility to make improvements to the distribution grid in furtherance of providing such middle-mile broadband Internet services in conjunction with its program of electric distribution projects;
(4) Whether it is in the public interest and the interest of the electric utility to operate middle-mile-broadband Internet assets to provide access to unserved and underserved areas of the state;
(5) Whether it is in the public interest and the interest of the electric utility to permit a third party to lease such capacity to provide last mile-mile broadband Internet services to unserved and underserved areas of the state;
(6) Whether construction of middle-mile broadband Internet infrastructure utilizing electric utility distribution systems is feasible with respect to the maturity of the relevant technology, the compatibility of such services with existing electric services, and the financial requirements to undertake such project;
(7) The anticipated level of rate adjustment necessary to allow the electric utility to recover its costs associated with the proposed project, and a reasonable rate of return, on a expedited basis, that will be recovered by the electric utility through a rate adjustment at the commission; and
(8) Such other information that is pertinent to the project.

While all of these aspects are covered in this section, they may be addressed in a somewhat different order for ease of presentation.

A. Scope of the Proposed Project (W. Va. Code §§ 31G-4-5(d) (1) (A) and (D))

Mingo and Logan Counties were chosen for this initial, middle-mile broadband infrastructure project, after discussions with the Council, based upon the following considerations:

- The Federal Communications Commission (FCC), in its 2019 Broadband Deployment Report, found that the percentage of 25/3 Mbps or greater broadband coverage in Mingo County and Logan County is only 63% and 67%, respectively. The FCC's method of mapping broadband coverage has been widely criticized as imprecise, inaccurate and unreliable by consumers, trade associations, lawmakers, other industry stakeholders, and even some of its own members. Even so, the reported percentages for Mingo and Logan Counties rank as relatively low coverage compared with similar rural counties in West Virginia. Clearly, these two counties rank as underserved areas of the State," [9] as that phrase is used in W.Va. Code § 31G-1-5 (a), with regard to existing broadband services. See the FCC maps of Mingo and Logan Counties, attached as Exhibit 2, which show broadband coverage in the two counties.

- As of September 2019, APCo has approximately 14,000 residential and business electric customers in Mingo County and approximately 17,900 residential and business customers in Logan County. Both counties are predominately rural.

- Over the next few years, fiber optic cable is planned to be installed to link transmission assets in Mingo and Logan Counties, including substations that have transmission assets (transmission substations), in order to improve the reliability of APCo's electric grid. A middle-mile project in these counties that utilizes a portion of the strands in that fiber optic cable would realize efficiency benefits in both a reduction in installation time and reduced project costs.

- Both Mingo and Logan Counties are Appalachian Regional Commission (ARC)-designated distressed counties affected by the decline of the coal industry.[10] Key economic indicators in these counties, such as unemployment, per capita market income and poverty rates have shown the need to stimulate economic growth and improve the standard of living through technology-related avenues. As such, bringing high speed Internet to these counties, in combination with increased electric reliability, will encourage economic development and potentially increase APCo's electric load, to the benefit of the Companies' electric customers.

[9] The term "underserved areas of the State" is not defined in W. Va. Code Chapter 31G. In Section 4.1.1 of its RFI, the Council states that it will consider any area a "Target Area" where there is credible information that the area is unserved.

[10] https://www.arc.gov/program_areas/ARCDesignatedDistressedCountiesFiscalYear2020.asap

The fiber optic cable that APCo would install in Mingo and Logan Counties as its proposed middle-mile broadband infrastructure expansion project would primarily be used for the Companies' internal communication needs. Consequently, there are three route options for the proposed project,[11] as follows:

- The Route 1 or "AMI" option would involve the installation of approximately 414 miles of 96-strand[12] fiber optic cable on APCo's distribution system in Mingo and Logan Counties. This mileage would be over and above that already planned for installation to connect APCo's transmission substations in Mingo and Logan Counties, back to Charleston and Huntington, West Virginia.[13] The Route 1 option would provide a robust communications platform to support the future deployment of two, initial grid modernization initiatives that APCo has planned for its West Virginia electric service

[11] Under each of the options, the proposed middle-mile broadband fiber assets would be connected to APCo's distribution infrastructure in the "power supply zone. This would minimize the need to change out poles so that adequate space is available on APCo's distribution infrastructure to meet NESC requirements.

[12] When deploying fiber optic cable for internal use, the Companies' standard practice (except for corridors with expected heavy communications traffic) is to use 48-strand cable. The next most-economical, industry-standard size is 96-strand cable. For maintenance purposes, the Companies' practice is to use only a few standard fiber optic cable sizes, because that avoids the higher cost of storing multiple cable sizes and minimizes the possibility that an incorrect cable size will be inadvertently installed. Additionally, the Companies' experience in deploying fiber cables over the past thirty years has demonstrated that the uses of fiber strands have continually expanded over time, which also militates in favor of installing a 96-strand cable as part of this proposed broadband expansion project. Recognizing the need for spares to accommodate repairs and upgrades, under any of the three optional routes, APCo would be able to make the capacity of up to 48-strands of fiber optic cable available for lease to last-mile broadband Internet providers, or other users of "dark fiber," upon completion of the proposed project.

[13] Approximately 62 miles of yet-to-be-installed fiber optic cable, out of approximately 187 miles of fiber that would link APCo's transmission substations and other transmission assets in Mingo and Logan Counties back to Charleston and Huntington, West Virginia, would need to be upgraded from 48 to 96 strand fiber optic cable as part of each option. Ninety-six strand fiber optic cable is already planned for installation along the remaining 125 miles because these miles are in a corridor with expected heavy communications traffic.

territory - - Advanced Metering Infrastructure (AMI)[14] and Distribution Automation/Circuit Reconfiguration (DACR).[15] While Route 1 involves a greater build-out of fiber optic cable than either Routes 2 or 3, it will enhance the reliability and security of the Companies' communications network, and provide a more extensive middle-mile broadband infrastructure in Mingo and Logan Counties. A map showing the Route 1 option, and the location of APCo's distribution infrastructure that would be utilized in connection with that option, is attached as Exhibit 3. In addition, a diagram illustrating how the fiber optic cable deployment under the Route 1 option would interact with the APCo's planned AMI and DACR installations is attached as Exhibit 4.

- Under the Route 2 or "DACR" option, APCo would install approximately 244 miles of 96-strand fiber optic cable. This mileage would be over and above that already planned for installation to connect APCo's transmission substations in Mingo and Logan Counties back to Charleston and Huntington, West Virginia. The Route 2 option would extend fiber to DACR recloser devices at locations that APCo has identified for future DACR installations. Unlike the Route 1 option, however, this option would not extend fiber to all of APCo's expected AMI access points in Mingo and Logan Counties. Although some AMI access points could be connected to the fiber optic cable under the Route 2 option, others would require the use of a cellular and RF mesh communications platform. A map showing the Route 2 option, and the location of APCo's distribution infrastructure that would be utilized in connection with that option, is attached as Exhibit 5. In addition, a diagram illustrating how the fiber optic cable deployed under the Route 2 option would interact with APCo's AMI and DACR installations is attached as Exhibit 6.

- The Route 3 or "Substation" option would involve the installation of approximately 167 miles of fiber optic cable to link all substations in Mingo and Logan Counties. This mileage would be over and above that already planned for installation to link APCo's transmission substations in Mingo and Logan Counties back to Charleston and Huntington, West Virginia. This option would not provide a fiber optic cable communications platform to support the future installation of either AMI meters or DACR reclosers in Mingo and Logan Counties, and, based upon APCo's experience in Virginia, the Companies are doubtful that this option would provide a middle-mile broadband infrastructure sufficient for potential ISPs to bring broadband Internet service to Mingo and Logan Counties. They are offering this option in case the ISPs to be identified by the Council as part of this process find it adequate to do so. A map showing the Route 3 option, and the location of APCo's distribution infrastructure that would be utilized in connection with that option, is attached as Exhibit 7.

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[14] AMI is an architecture for automated, two-way communications between an AMI or "smart" meter and a utility company. An AMI meter communicates with relays and/or access points. The access points then communicate with the head-end system on a utility server.

[15] A DACR scheme functions by monitoring electric current levels at multiple points along a circuit and automatically communicates between switching points and distribution control equipment.

Mingo and Logan Counties are currently served by several major ISPs, including Shentel, Suddenlink, Frontier, Inter Mountain Cable, Xfinity and Armstrong, which could potentially extend Internet service further into those counties as a result of the proposed project. There may also be additional potential users of "dark fiber" that would become available under the Companies' proposed project. In order for the Council to identify one or more last-mile broadband Internet providers, or perhaps others,[16] that may lease part or all of the middle-mile broadband Internet capacity that would be created by the proposed project, as required by W. Va. Code § 31G-4-5(f), the Council could issue Requests-for-Proposals (RFP),[17] or otherwise seek input from potential users, about which of the three route options meets their needs as to middle-mile broadband infrastructure in Mingo and Logan Counties. This approach could allow the Council to determine which route would be appropriate for APCo to pursue further, with the identified last-mile broadband Internet providers, once the Council rules upon the feasibility of the Companies' proposed project.

[16] Under W. Va. Code § 31G-4-5(f), as part of its consideration of a feasibility study, the Council is to identify one or more last-mile broadband Internet providers that may lease the middle-mile broadband Internet capacity created by the proposed project, pursuant to lease terms and conditions set by the Council. Given that the Companies' proposed project may create more broadband capacity than currently needed by the Companies, for their internal communication needs, and by the last-mile broadband Internet providers identified by the Council, it is APCo's intention to lease as much of the remaining "dark fiber" capacity as is possible to third parties. In this regard, the Companies are interested in maximizing the lease payments and maintenance fees it collects from third-party lessees, as it is their proposal that such lease payments and maintenance fees be credited to the cost-of-service when the Commission establishes any revenue requirements and rates associated with constructing a project and operating middle-mile broadband infrastructure. The Companies look forward to working with the Council and the Commission to be able to lease such "dark fiber" to third parties, in a non-discriminatory way, that maximizes the benefit to their electric customers.

[17] The Companies would note that an RFP was issued by Grayson County Virginia when it chose an ISP to provide Internet service within that county. As part of a broadband pilot program submitted to the Virginia State Corporation Commission for approval, APCo is working with that ISP, and Grayson County, to make middle-mile, broadband capacity available in unserved areas of Grayson County.

B. Cost of the Proposed Project and Anticipated Level of Needed Rate Adjustment (W. Va. Code §§ 31G-4-5(d) (1) (B) and (d) (7))

The Companies have developed preliminary estimates of both the initial capital investment that APCo would need to make to install each of the three route options, and the associated annual operation and maintenance (O&M) expense. The costs for each route include a preliminary estimate of the appropriate share of the costs of the fiber optic cable already planned to be installed to link APCo's transmission substations in Mingo and Logan Counties, back to Charleston and Huntington, West Virginia. Table 1, below, provides a summary of these costs.

Table 1

Mingo and Logan Counties

(Estimates-in millions)

	Route 1 ("AMI")	Route 2 ("DACR")	Route 3 ("Substation")
	414 miles of fiber	244 miles of fiber	167 miles of fiber
Total Estimated Initial Capital Investment	$54.6	$34.5	$25.3
Total Estimated Annual O & M Expense	$1.8	$1.1	$0.8

These costs are for the fiber optic cable communications platform only, which includes necessary mounting, hardware, splice enclosures, and fiber optic cable drop locations into the communications space, but not such things as the cost to reconfigure DACR circuits, or to purchase and deploy AMI meters, RF mesh relays associated with the AMI network, AMI access points, or DACR equipment, such as reclosers.

The capital cost estimates depicted in Table 1 factor in the challenging terrain in Mingo and Logan Counties. The direct cost to install 96-stand fiber optic cable in these counties is estimated to be approximately $60,000 per mile, while pole replacements are estimated to be three per mile, which corresponds to approximately $15,000 per mile.[18] While they are not broken out separately, the capital costs in Table 1 also reflect estimates of preliminary engineering costs, any expected permitting costs, materials (including necessary hardware), labor, a telecommunications building to hub (i.e. house) ISP electronics, and right-of-way costs. Once the Council has approved the proposed project and identified one or more ISPs that may lease portions of the middle-mile broadband infrastructure that will be available upon completion of the proposed project; a specific route has been selected; and any necessary "next steps" have been completed that will allow the Companies' proposed project to move forward, the Companies will be in a position to further refine these estimates. The Companies are committed to working with the Council, the Commission, and all other interested parties, to do so in a timely manner.

Based upon the initial capital investment and annual O&M expense shown on Table 1, the Companies developed an estimate of the first year annual revenue requirement (excluding consideration of yet unknown lease payments and maintenance fees) associated with each of the three possible routes for the proposed project. Those estimated annual revenue requirements for Routes 1, 2 and 3, as shown on Exhibit 8, would be approximately $8.8 million, $5.6 million, and $4.1 million, respectively. These amounts, which reflect APCo's current Commission-authorized rate of return of 7.283% (based upon its authorized 9.75% return on common equity), represent the anticipated level of rate adjustment (excluding consideration of yet unknown lease payments and maintenance fees) that

[18] Even though the fiber optic cable can be installed in the "power supply zone," some of APCo's poles in Mingo and Logan Counties are likely to be too short to accommodate the installation of the proposed fiber optic cable.

would be necessary for APCo to recover the costs associated with the proposed project over approximately 30 years. Using a cost allocation methodology consistent with ones previously approved by the Commission in past base rate proceedings, the Companies estimate the bill impact on residential customers using 1,000 kWh a month to be as follows: $1.13 per month, or about $13.51 per year for Route 1; $0.71 per month, or about $8.53 per year for Route 2; and $0.52 per month, or about $6.26 per year for Route 3.

The estimated revenue requirements and residential bill impacts described above do not reflect any lease revenues or maintenance fees that APCo would receive from ISPs or other potential broadband lessees, because the Council has not yet established any lease terms or conditions per W. Va. Code § 31G-4-5(f).[19] It is the Companies' proposal, both for this proposed project, as well as for future projects, that all such lease revenues and maintenance fees be credited to the cost-of-service when the Commission establishes any revenue requirement and rates associated with constructing a project and operating middle-mile broadband infrastructure.[20] To maximize such lease revenues and maintenance fees, the Companies suggest that the Council consider asking potential lessees, or at least potential last-mile Internet providers in Mingo and Logan Counties, to submit responses to an RFP that indicate the number of miles and fiber optic cable strands they require, and the level of lease payments and maintenance fees they would be willing to pay for access to the middle- mile broadband infrastructure that the Companies are proposing to construct and operate in this filing.

[19] It is unclear to the Companies if the Council intends to establish the lease terms or conditions applicable to third-party lessees of "dark fiber" still available once APCo has entered into leases (pursuant to terms and conditions set by the Council) with one or more last-mile broadband providers. As indicated in footnote 15, the Companies look forward to resolving this issue with the Council and the Commission.

[20] Once lease terms are established, the Companies will be in a better position to estimate the level of lease revenues and maintenance fees that would be credited to cost-of-service.

The Companies recognize that W. Va. Code § 31G-1-2 authorizes the Council to seek non-state funding and grants to support and fund projects and initiatives in furtherance of broadband expansion in West Virginia. Given this authority, the Companies do not intend to pursue any such grants, but will work with the Council to ensure that any grants that the Council might obtain are used to further this legislative goal; thereafter they would be in a better position to determine the impact, if any, that any such grants have on the cost of the proposed project.

C. Public Interest and Feasibility (W. Va. Code §§ 31G-4-5(1) (3),(4),(5) and (6))

W. Va. Code §§ 31G-4-5(d)(3)(4) and (5) require that any electric utility that investigates the feasibility of constructing and operating a middle-mile broadband infrastructure project within its electric distribution system shall evaluate whether it is in the public interest, and the interest of the electric utility, to do the following:

- make improvements to the distribution grid in furtherance of providing such middle-mile broadband Internet services in conjunction with its program of electric distribution projects;
- operate middle-mile broadband Internet assets to provide access to unserved and underserved areas of the state; and
- permit a third party to lease such capacity to provide last-mile broadband Internet services to unserved and underserved areas of the state.

W. Va. Code § 31G-4-5(d)(6) also requires an evaluation of whether the proposed project is feasible with respect to the maturity of the relevant technology, the compatibility of such services with existing electric services, and the financial requirements to undertake such project. There are several reasons why the proposed project is in the public interest, in the interest of the Companies and their electric customers, and feasible.

To begin with, the Legislature has determined that the extension of broadband service into rural areas of West Virginia is a primary state goal. Because the Companies already have an extensive distribution system infrastructure throughout the rural parts of West Virginia in which they provide electric service, and they are permitted to install communications equipment (such as fiber optic cable) in the "power supply zone" on that distribution system, they are in a unique position to install middle-mile broadband infrastructure on that distribution system in a timely, safe and cost-effective manner. The Companies also have over 30 years of experience in deploying fiber optics cable- -a mature, technology that has been in use as a communications medium for over 30 years; has a long expected service life (approximately 30 years); and is compatible with the Companies' existing, electric services - - for use as an internal communications system within their electric service territories.

The Companies have embarked upon a distribution grid modernization program designed to improve the reliability of their West Virginia customers' electric service. In the more urban areas of the Companies' West Virginia service territories, which have more broadband and cellular coverage, such modernization can proceed with less additional communications infrastructure. In the rural areas of their service territories, however, due to the limited extent of broadband and cellular coverage, and the more rugged, mountainous and wooded terrain, additional communications infrastructure is required. It is possible to modernize the distribution system in the Companies' service territories currently without a fiber optic cable communications system. While such a system would provide a more robust, secure and "future-proof" communications system, it would also be more costly than other available options.

Over the next decade, the Companies' grid modernization efforts are expected to focus on installing AMI meters[21] and DACR technologies. AMI meters and DACR technology offer significant

[21] The Automated Meter Reading (AMR) meters currently being used by the Companies in their West Virginia service territories, which only provide one-way communication, are nearing the end of their useful service lives.

potential benefits to customers and the Companies. For example, AMI meters will serve as a link to the Companies' Outage Management System, which, among other things, will help pinpoint the location of outages in real time; allow the Companies to remotely connect or disconnect electric service in minutes, saving time and money; provide customers the opportunity to access information about their energy usage, which can help them manage their costs; permit the Companies' customer service representatives to access more detailed usage information to assist in resolving customer inquiries; support alternative rate designs, such as time-of-day rates, and expanded payment options; and provide the two-way communications necessary to integrate Distributed Energy Resources into their distributions grid. AMI meters will also improve safety for the Companies' employees by reducing miles driven and limiting exposure to potential hazards associated with physically accessing the meter location, and increase meter operations efficiency by eliminating the need for various trips to the meter location. These improvements will drive system efficiencies and help control costs, to the benefit of customers.

DACR technology offers similar benefits. A DACR scheme functions by monitoring electric current levels at multiple points along the circuit and will automatically communicate between switching points and distribution control equipment to "self-heal" the grid when a fault is detected between switching points. Once a fault is detected, the automated switches on either side of the faulted section or "zone" of the circuit are automatically opened and the normally open switch positioned between the affected circuit and the backup or adjacent circuit closes. Customers on both sides of the faulted line section experience a brief interruption but avoid a sustained outage. As a result, fewer customers experience a sustained outage. The automated switches isolate the faulted section and pinpoint the damaged area for repair crews, which can decrease the time it takes to address the outage and restore service. The DACR system continuously monitors the loading on each line section and in the event of a fault determines how much load can be transferred to the backup circuit based upon the current loading

and the thermal limitations of the circuit. In some cases, power can be restored automatically, thereby reducing the number of sustained outages that occur while a crew is mobilized to initiate troubleshooting and effect repairs.

The proposed project offers the potential to bring both high-speed Internet and improved, cost-effective electric reliability to Mingo and Logan Counties. This combination can be expected to encourage economic development in these counties, which is in the public interest because it will benefit not only those counties but also West Virginia and all of its citizens.

It has been the Companies' experience that industry and businesses are not likely to locate in areas that lack high-speed, and highly-reliable, Internet service. For over a century, the Companies have been helping localities across their West Virginia service territories grow and prosper by being involved in various aspects of economic development. From site selection, to incentives for community development, to economic development initiatives authorized by the Commission,[22] the Companies work closely with businesses to encourage them to locate or expand their operations in West Virginia. The Companies are already working with local, county, regional and State officials to promote economic development in West Virginia, and the proposed project will provide additional tools to allow the Companies and those officials to support economic development in Mingo and Logan Counties.

The proposed project should also enable Mingo and Logan Counties to attract and retain a work force for existing and prospective industry, while improving the quality of life of their citizens, including senior citizens and low-income households. High-speed broadband Internet services offer the opportunity to improve education by connecting schools, their students and libraries to the world. It provides more reliable and efficient communications for emergency service providers and first

[22] For example, the Companies have an approved Experimental Economic Development Rider and an Economic Development Advantage Program.

responders, thereby improving public safety. It offers new ways to deliver health care, and it allows citizens to pursue their own careers and business goals, through such things as tele-commuting.

Economic development in the rural areas of West Virginia is not only beneficial, and in the public interest for those areas, their inhabitants and the entire State, but also for the Companies and their electric customers. By bringing new industry and businesses into their West Virginia service territories, and thereby slowing or even reversing the exodus of residential customers, economic development has the potential to increase the Companies' West Virginia electric load, which has been declining over the last several years and is projected to continue to decline in the future. Adding electric load in their West Virginia service territories would allow the Commission to spread the Companies' fixed costs over more units, thereby potentially reducing customers' electric rates, or at least limiting future rate increases.

Besides being in the public interest and the interest of the Companies and their customers, as indicated above, the proposed project is also feasible with regard to the maturity of the fiber optic cable technology that would be used to provide the proposed middle-mile broadband infrastructure, and the compatibility of that proposed communications infrastructure with the Companies' existing electric service. In addition, the proposed project is feasible with respect to the financial requirements necessary to undertake such a project. In this regard, the Companies, which have for years been called upon, as regulated electric utilities, to make capital intensive electric utility investments, and operate and maintain the assets created by such investments, can make investments in middle-mile broadband infrastructure, and operate and maintain such infrastructure.

D. Regulatory and Legal Barriers, and Proposed Legislation (W. Va. Code § 31G-4-5(d) (2))

There are a number of potential regulatory and legal barriers that will need to be addressed, perhaps through legislation, before either the proposed project, or future projects, can proceed in West Virginia. From the Companies' perspective, the most important barrier involves cost recovery, given not

only that the installation of fiber optic cable on the Companies' distribution system is not the lowest cost option for grid modernization initiatives in their service territories, but also that it would require the installation of more fiber optic cable (e.g. 96 strands rather than 48 strands) than would be utilized solely for the Companies' own internal communication needs.

While W. Va. Code § 31G-4-5 (d)(7) does require, and the Companies have provided in this filing an estimate of the anticipated level of rate adjustment necessary to allow APCo to recover its costs associated with this specific proposed project, that statute does not provide reasonable assurance of such cost recovery. In order to proceed with the proposed project, and future projects, the Companies would need reasonable assurance, either through a new statute, or possibly a Commission pronouncement, that the full cost of any broadband infrastructure project, which is determined to be feasible by the Council, for use as both a communications platform for grid modernization and as the middle-mile infrastructure for broadband Internet service, is recoverable from the Companies' West Virginia electric customers. Of course, the Companies recognize that they would need to demonstrate, to the Commission's satisfaction, that the level of costs they incur to construct, operate and maintain such broadband infrastructure is reasonable and prudent.

Consistent with the language of W. Va. Code § 31G-4-5 (d) (7), which indicates that cost recovery would be "on an expedited basis," the recovery of such costs would need to be through a rate adjustment mechanism separate and distinct from base rates, such as a construction surcharge, which would allow for cost recovery both as the project is being constructed and after it is complete. The Companies pledge to work with the Commission, the Council and other interested parties to get such a rate adjustment mechanism in place.

One way to potentially mitigate the costs associated with an electricity utility extending middle-mile broadband infrastructure into rural areas of West Virginia could come through state tax policy. For

example, a tax credit for electric utilities that construct middle-mile broadband infrastructure, similar to the credit for industrial expansion and industrial revitalization provided under W. Va. Code § 11-13-3d, might be worthy of consideration.

While the Companies have not identified any West Virginia laws or regulations that specifically preclude them from owning, operating, maintaining and leasing fiber optic cable capacity they install on their distribution system to third parties,[23]either as the middle-mile broadband infrastructure for last-mile Internet services, or to other potential users of such fiber optic cable, it would be beneficial to have legislation that authorizes an investor-owned electric public utility, either directly or indirectly, and regardless of any limits in its Articles of Incorporation,[24] to 1) own, operate, manage, control and maintain any middle-mile broadband capacity, equipment and electronics, including any plant, works, system, lines, facility, or properties, or any part or parts thereof, together with all appurtenances thereto, used or useful in connection with the provision and extension of middle- mile broadband capacity;[25] 2) lease indefeasible rights of use in such broadband capacity, equipment and electronics in areas of their West Virginia service territories, whether or not unserved or underserved by broadband,

[23] The Companies estimate that approximately five (5) percent of their easements in West Virginia contain provisions that preclude them from installing facilities on their distribution system that are not solely for purposes of providing electric service. Before the proposed project could move forward, those easements would need to be identified and revised, and any costs to do so would need to be recoverable as part of the total costs of the proposed project.

[24] Alternatively, such utility would need to have an opportunity to modify its Articles of Incorporation, if necessary.

[25] Because the fiber optic cable to be installed under the proposed project would be located in the "power supply zone," and would be used for the Companies' internal communications needs, only APCo personnel, or authorized APCo contractors, will be permitted to install, operate, maintain and restore that fiber optic cable.

to third parties;[26] and 3) provide access points that are outside of the utility's energized zone to allowconnection between the utility's broadband capacity and the lessee's system.

E. Proposed Construction Schedule (W. Va. Code § 31G-4-5 (d) (1) (c))

As indicated throughout this Study, there are a number of "next steps" that will need to be worked out and completed before the proposed project can move forward, even after it is determined to be feasible by the Council. Consequently, the construction schedule will be dependent upon such things as the scope of the project (e.g. whether Routes 1, 2 or 3 are to be built); the availability of construction resources; and when each of the "next steps" identified in this Study is completed. Once construction starts, the Companies estimate that it will take from 18 to 30 months to complete the proposed project.

III. Identification of Third-Party Lessees and Determination of Lease Terms and Conditions (W. Va. Code, § 31G-4-5 (f))

W. Va. Code § 31G-4-5 (f) provides that, as part of its consideration of the feasibility of a middle-mile broadband infrastructure expansion project proposed by an electric utility, the Council shall do two things, as follows: identify one or more last-mile broadband Internet providers that may lease the middle-mile broadband capacity created by the proposed project; and set the lease terms and conditions under which the middle-mile broadband capacity created by the proposed project may be

[26] As indicated previously in this Study, a 96-strand fiber optic cable is the most economical cable to install as part of the proposed project, which means that APCo will have up to 48 strands of broadband capacity to lease to third parties. Because APCo will offset the costs of the proposed project by any lease payments and maintenance fees it collects from lessees, the Companies suggest that the broadband capacity created as a result of the proposed project be made available not only to ISPs that will provide last-mile Internet service to Mingo and Logan Counties, but also to any other third parties requiring broadband capacity. In this regard, the Companies have already identified potential "dark fiber" leasing opportunities with such entities as wireless carriers, as well is educational, healthcare and financial organizations, and they look forward to working with the Council and the Commission to explore how best to pursue such opportunities.

leased by such entities. The Companies would appreciate the opportunity to work with the Council, as well as public officials for Mingo and Logan Counties, to identify potential lessees for the fiber optic cable broadband infrastructure that would be created by the proposed project, if it is determined to be feasible by the Council. Once such lessees are identified by the Council, the Companies would also appreciate the opportunity to again work with the Council and public officials from Mingo and Logan Counties, as well as the potential lessees identified by the Council, to help it establish the lease terms and conditions under which APCo would lease broadband capacity created by the proposed project to those entities. To this end, and with the understanding that the subjects discussed below are not intended to be all-inclusive, the Companies offer the following observations to facilitate these next-step processes.

As described above, the Companies have identified a 96-strand fiber optic cable as the cost-effective cable size to install as part of the proposed project. Given that the Companies require 48 strands for internal communication purposes, the proposed project will create up to 48 strands of fiber optic cable that could be leased to third parties. Consequently, the Companies suggest that the Council strive to identify as many potential lessees of that capacity as possible. One way to do so would be for the Council, or Mingo and Logan Counties working with the Council, to allow all potential users, including but not limited to, last-mile ISPs that would serve Mingo and Logan Counties, wireless carriers, and educational, health-care and financial organizations, to bid on the broadband capacity that will be available to lessees as a result of the proposed project.

Making the broadband capacity to be created by the proposed project available to as many lessees as possible would have a number of benefits. Doing so would maximize not only the potential use of as many of the available strands as possible, but also the amount of lease revenues and maintenance fees that APCo would collect from lessees, which APCo would credit to its electric cost-of-service when the Commission establishes the revenue requirements and rates associated with the

proposed project. Such a process could be conducted through an RFP[27] issued either solely by the Council, or by it working with Mingo and Logan Counties, the Companies and other interested parties.[28] It could also be used to help the Council determine which of the three routes described in this Study would best meet the need for middle-mile broadband infrastructure in Mingo and Logan Counties, recognizing one of the Council's stated objectives, which is to "provide operators of last-mile networks in currently unserved areas access to low cost Internet bandwidth and data transport services, to improve the business case for these networks."[29] In this regard, any entity responding to such an RFP should be required to indicate the number of strands, as well as the number of miles, and which miles of fiber optic cable, it seeks to lease from APCo. In parallel with the process the Council initiates to identify potential lessees of the broadband capacity to be made available under the proposed project, the Companies further recommend that the Council begin developing the lease terms and conditions under

[27] The Council has already indicated, in Section 2, Item 3, of its RFI, that it may issue subsequent RFPs.

[28] The Companies understand that W. Va. Code § 31G-4-5(f) might be interpreted as requiring the Council to identify only one or more last-mile broadband Internet providers to lease broadband capacity from a proposed project. As indicated previously, the Companies expect to work with the Council and the Commission to establish procedures for leasing broadband capacity to other potential users of that capacity, in a non-discriminatory manner, recognizing that there will be a limited amount of such capacity (i.e. only up to 48 strands) available to lease.

[29] See Section 5.2.3.1 of the Council's RFI.

which those lessees will lease that capacity. While the following list is not meant to be all-inclusive, the Companies recommend that those lease terms and conditions cover and include the following:

1. the number of strands and miles of fiber optic cable covered by the lease;
2. the amount of lease payments and maintenance fees to be paid by the lessee to APCo;
3. provisions that indicate that only APCo, or its authorized contractors, will be permitted to install, operate, maintain and restore any of the fiber optic cable strands that are the subject of the lease;
4. the location of access points outside of APCo's energized zone, to which the lessee can connect its system to APCo's broadband capacity; and
5. the estimated construction schedule.

The Companies request that they be given an opportunity to work with the Council, and any interested parties, before the Council finalizes lease terms and conditions.

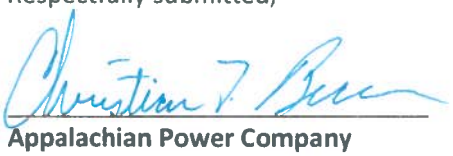
IV. Conclusion

The Companies appreciate the opportunity to submit this Study, and future feasibility studies, to the Council for its consideration. As required by W. Va. Code § 31G-4-5 (e), the Companies understand that the Council will post this Study on its website for written public comment. The Companies request that they be given a reasonable opportunity to respond to such comments. The Companies further request that the Council render its determination of the feasibility of the proposed middle-mile broadband infrastructure expansion project described and evaluated in this Study within 60 days of its submittal date, as required by W. Va. Code §31G-4-5(f).

As indicated throughout this Study, there are a number of "next steps" that would need to be completed, even after the Council determines that the proposed project is feasible, before it could move forward. Those "next steps" include, among other things, the resolution of various legal and regulatory

barriers to the proposed project; the identification by the Council of one or more last mile broadband Internet providers, and potentially other entities, that could lease middle-mile broadband capacity to be installed by APCo under the proposed project; and the establishment of specific lease terms and conditions by the Council under which ISPs and potentially others would lease middle-mile capacity from APCo. The Companies pledge to work with the Council, the Commission, Mingo and Logan Counties, and other interested parties to resolve these next steps in an orderly and timely manner.

Respectfully submitted,



Appalachian Power Company
and Wheeling Power Company
By Christian T. Beam
President and COO

APPENDIX OF BACKGROUND INFORMATION

To develop this Study, Appalachian Power Company and Wheeling Power Company (the Companies) reviewed several referenced documents and recent broadband studies from across the country to expand their knowledge of various challenges associated with, and solutions to, broadband expansion. They also conferred with members of the Council, local officials, state organizations, electric utility peers, ISPs and wireless carriers, along with others who have an interest in expanding and improving broadband service availability to underserved and unserved areas in West Virginia. The Study was also presented to the Staff of the Commission before filing. Combined, the insight gained from outreach to these external resources was invaluable to the development of this Study.

The Companies and their parent, American Electric Power Company, Inc. (AEP), are aware of the digital divide between Americans with, and without, access to modern broadband. They recognize that modern society is an increasingly digital one, and accessing advanced services is essential to ensuring that all Americans can participate and thrive. Positive social-economic impact and value, for its customers specifically and West Virginia generally, can be realized with broadband deployment in the rural portions of the Companies' service territories.

This Appendix discusses the fundamental requirements for broadband development, examines current access to broadband in West Virginia, and reviews various approaches to

deploying infrastructure and providing broadband services. In conjunction with the Study, it also considers how the Companies can support broadband expansion in the context of planned grid modernization programs.

Federal, state, and local entities have repeatedly recognized the importance of access to broadband services as a fundamental prerequisite for enabling economic development and for improving education, public safety, health care and government services, among other benefits. Nationally, the FCC's National Broadband Plan states that:

> Broadband is the great infrastructure challenge of the early 21st century. Like electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life. It is enabling entire new industries and unlocking vast new possibilities for existing ones. It is changing how we educate children, deliver health care, manage energy, ensure public safety, engage government, and access, organize and disseminate knowledge. [1]

Yet, data in the FCC's 2019 Broadband Deployment Report conservatively demonstrates that six percent of Americans, over 19 million households, lack access to [broadband] capability and that the situation is especially problematic in rural areas, where over 24% lack access. [2]

Within the State of West Virginia, the importance of broadband is illustrated by the Legislature's passage of W. Va. Code Chapter 31G, which established the Council with the goal "to provide for and oversee the development of plans, processes and procedures for extending

[1] Barry Leonard, National Broadband Plan,Executive Summary, Federal Communications Commission, last modified 2010, https://www.fcc.gov/general/national-broadband-plan (National Broadband Plan).

[2] Sections VI.76 and 79. Section 706 Finding, FCC 2019 Broadband Deployment Report (May 29, 2019).

broadband access into underserved and unserved areas of West Virginia."[3] The State of West Virginia has clearly recognized the importance of broadband and the need to "[e]xplore any and all ways to expand access to broadband services."[4] Expanding broadband services will increase social-economic value in many areas and aspects for the residents of West Virginia. The following list, while cursory and incomplete, indicates the potential:

- Education Services
- Career Readiness
- Workforce Preparation
- Alternative Career Training
- Increased Property Value and Home Sale Opportunity in Rural Areas
- Telecommuting and Home-based Business
- Tele-health, Tele-medicine and Connected Care Programs
- Public Safety
- Entertainment, Television and Gaming Industry

The Companies understand that many counties in West Virginia, in partnership with the Council, are coordinating funding for broadband improvements. Some of these counties have also hired independent consulting firms to conduct broadband studies that detail their current

[3] W. Va. Code §31G-1-1(5).
[4] W. Va. Code § 316G-1-4 (a)(1).

state of broadband coverage, and to make infrastructure improvements to support broadband development. This is important since the FCC has recognized that the granularity of its data is not perfect, and it is continually considering ways to improve that data. Just one example of this is Roane County. With help from an independent consulting firm, Roane County conducted a broadband survey in the fall of 2018, and early winter of 2019, as part of a comprehensive broadband study. A few of the key findings from this report are that 96% of respondents want better Internet service, 93% of residents are "not satisfied" or "only somewhat satisfied" with current Internet service, and that 54% of respondents indicated that they have no alternative to their current Internet provider.[5] This is in contrast to FCC maps that display middle- range to high-range Internet speeds for many residents in Roane County. [6]

The Companies' research indicates that much of the broadband infrastructure and services in West Virginia have been developed for the purpose of meeting customer demand; enhancing education, government, public safety, and other services; or supporting internal business functions. As a result, densely populated areas and critical institutions, such as schools, hospitals, and public safety entities, have generally been the focus of broadband deployment. The patchwork of underserved areas across the State of West Virginia reflects the outcome of this approach. Broadband infrastructure in West Virginia has been planned and developed by a variety of entities. The Appalachian Region Commission (ARC) has granted funding to West Virginia with a focus on 10 counties for the development of the West Virginia Broadband

[5] Design Nine, Inc., RESIDENTIAL AND BUSINESS BROADBAND SURVEY RESULTS, Roane, Calhoun, and Clay Counties, WV, Blacksburg, VA (2019).
[6] https://broadband.wv.gov/wv-maps/fixed-wireline-speeds.

Development Hub (Broadband Hub). The Broadband Hub is a partnership among several agencies including the West Virginia Geological Survey (WVGES), the Council, the West Virginia Development Office, and the West Virginia Division of Highways.

Outside of Logan and Mingo Counties, which are the proposed locations of the Companies' initial middle-mile broadband infrastructure expansion project, other West Virginia counties are working on the following initiatives:

- Brooke County-Lead for Regional Project - Brooke-Hancock Regional Plan
- Clay County-Lead Applicant for 3- County Regional Project - Calhoun-Clay-Roane Regional Plan
- Fayette County - Fayette County Broadband Plan
- Gilmer County-Braxton County - Fixed Wireless Design Plan
- Grant County - Grant County Broadband Plan
- Hampshire County - Capon Bridge Broadband Fiber Expansion Project
- Jackson County - Sandyville Tower Wireless Project
- Jefferson County - Jefferson County Broadband Plan
- Lewis County - Southern Lewis County Expansion Project
- Marshall County-Lead for Regional Project - Marshall-Ohio-Wetzel Regional Broadband Plan
- Mason County - Mason County Broadband Plan
- McDowell County - Bull Creek – Isaban Area Expansion Project
- Mercer County - Cumberland Industrial Park Expansion Project

- Morgan County - Morgan County Broadband Plan
- Multi-County Project - Mountain State Broadband Expressway Tower Project
- Nicholas County - Hinkle Mountain – Little Laurel Expansion Project
- Nicholas County-Richwood - Richwood-Hinkle Mountain Pilot Project
- Pocahontas County - Pocahontas County Broadband Plan
- Taylor County-Lead Applicant for 6-County Regional Project - Regional Broadband Strategic Plan, includes Taylor, Doddridge, Harrison, Marion, Monongalia and Preston counties.
- Tyler County - Tyler County Broadband Plan
- Upshur, Barbour, Randolph Counties - Central WV Development Corporation
- Wayne County - Wayne County Broadband Plan

Funding for these projects started in 2017. This list includes projects from 40% of all counties within West Virginia. The importance of broadband expansion throughout West Virginia is clear based upon the amount of current projects in place, and discussions around creating more. The challenge is how to rapidly deploy broadband in rural West Virginia. In this regard, it is important to have an understanding of the key elements of the broadband network and the primary entities involved in the development and operation of this network.

Two key aspects of the broadband network are the “middle-mile” and the “last-mile.” The middle-mile refers to the infrastructure connecting the last-mile service network to a provider’s backbone network that ultimately provides access to the global Internet. The last-mile involves the infrastructure connections and services provided to the end user. In general, the middle-mile

primarily consists of fiber optic cable, although it could involve microwave towers and possibly other similar "line-of-sight" wireless technology. The last-mile is comprised of a variety of wired and wireless options designed to meet the characteristics of end users, topographic features, and other service territory-specific variables. Various entities have invested in middle-mile and/or last-mile assets, including local exchange carriers, wireless carriers, municipalities, as well as electric and telecommunication cooperatives. The Companies' Study has evaluated the feasibility of supporting the development of middle-mile infrastructure as a communication platform that could also be used in conjunction with grid modernization programs. This approach provides options for last-mile connection and Internet service offerings, as well as uses of "dark fiber," by other entities.

Installation of the backbone middle-mile infrastructure (fiber or microwave) is expensive. The Companies' preliminary direct cost estimate in 2019 dollars is roughly $60,000 per mile of fiber dependent on terrain and resources. The Companies' research suggests that ISPs have found it difficult to incur this expense, and still provide reasonably-priced Internet service to rural West Virginians. One newspaper summed up the situation as follows: The real problem with the expansion of rural broadband "is the failure to build a middle-mile fiber backbone throughout the state, which would connect rural areas to the national backbone, [and] allow access to different providers."[7]

[7] "Middle mile" key to rural broadband, The Pocahontas Times, March 12, 2014, https://pocahontastimes.com/middle-mile-key-to-rural-broadband/.

For many areas in West Virginia, including the rural portions of the Companies' service territories, efforts to expand broadband access must address significant barriers associated with low population densities and topography. As concluded in the FCC National Broadband Plan:

> [T]he cost of ... middle-mile connectivity has a direct impact on the cost of providing broadband service in unserved areas of the country. (p. 148) [In fact,] the middle-mile transmission often represents a significant cost for carriers that need to transport their traffic a significant distance to the Internet backbone.[8]

Further, describing the unfavorable economics of expanding into low population and geographically isolated areas, the National Broadband Plan notes that:

> The rates that firms pay for these critical middle- and second-mile connections have an impact on the business case for the provision of broadband in high-cost areas. Small local exchange carriers, wireless firms and small cable companies typically purchase these connections from other providers.[9]

Ideally, the planning and execution of initiatives to develop middle-mile and last-mile investments would occur in parallel, as the success of one is dependent upon the success of the other. This dependence is discussed in the National Broadband Plan, which states:

> [b]y solving the middle-mile problem, the hope is to foster investment in "last mile" facilities to provide service to individuals and institutions that need it.[10]

When broader collaboration occurs to strategically plan, construct, and operate broadband networks, there is a stronger likelihood for more cost-effective and successful development. The FCC National Broadband Plan notes that strategically planning expansion efforts can produce more cost effective and feasible solutions:

[8] National Broadband Plan at 140.

[9] National Broadband Plan at 143.

[10] National Broadband Plan at 343.

> Because broadband networks—particularly fiber optic networks—demonstrate large economies of scale, bulk purchasing arrangements for forms of connectivity like second-mile and middle-mile access can drive down the per-megabit cost of such access considerably.[11]

Using an existing electric service provider to bring broadband access to rural America has been successful in a number of other states throughout the country. Electric Cooperatives are noted as the success driver behind broadband expansion in North Dakota and South Dakota, which are both regarded as two states with some of the fastest connectivity in the United States.[12] More than 140 Co-ops across the country now offer residential gigabit (1,000 Mbps) Internet access to their members, reaching more than 300 communities.[13] Regulated electric utility companies are also regarded as a potential source for broadband expansion because of the current infrastructure in place to transmit/distribute electricity. These companies also have regulated electric rates.

As indicated in their Study, the Companies are committed to working collaboratively with the Council, the Commission, local officials, state organizations, electric utility peers, ISPs, wireless carriers, along with others who have an interest in expanding and improving broadband availability to underserved and unserved areas in West Virginia. This commitment to collaboration extends not only to the specific middle-mile broadband infrastructure expansion project proposed in this Study, but also to West Virginia's stated goal of making every municipality, community, and rural area in the State accessible to Internet communications

[11] National Broadband Plan at 154.

[12] https://muninetworks.org/content/south-dakota-cooperative-brings-super-fast-Internet-rural-residents.

[13] https://muninetworks.org/reports/cooperatives-fiberize-rural-america-2019-Update.

through the expansion, extension and general availability of broadband services and technology.

Exhibit Descriptions

Exhibit 1 –Utility Pole Diagram

Exhibit 2 - FCC maps of Mingo and Logan Counties

Exhibit 3 – Map of Route 1 Option – “AMI” Route

Exhibit 4 - Diagram of how fiber optic cable deployment under Route 1 option would interact with APCo’s AMI and DACR installations

Exhibit 5 – Map of Route 2 Option – “DACR” Route

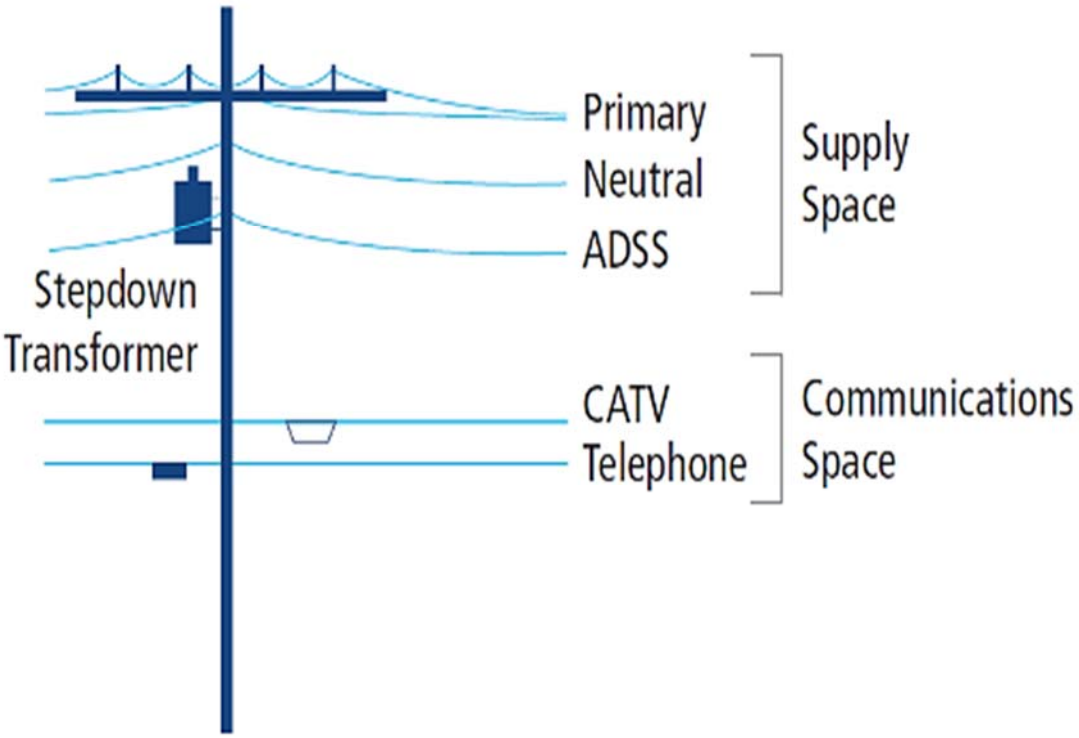
Exhibit 6 – Diagram of how fiber optic cable deployed under Route 2 option would interact with APCo's AMI and DACR installations

Exhibit 7 - Map of Route 3 Option – “Substation” Route

Exhibit 8 – First Year Annual Revenue Requirement for Routes 1, 2, and 3; Residential Bill Impact

Exhibit 1

Utility Pole Diagram



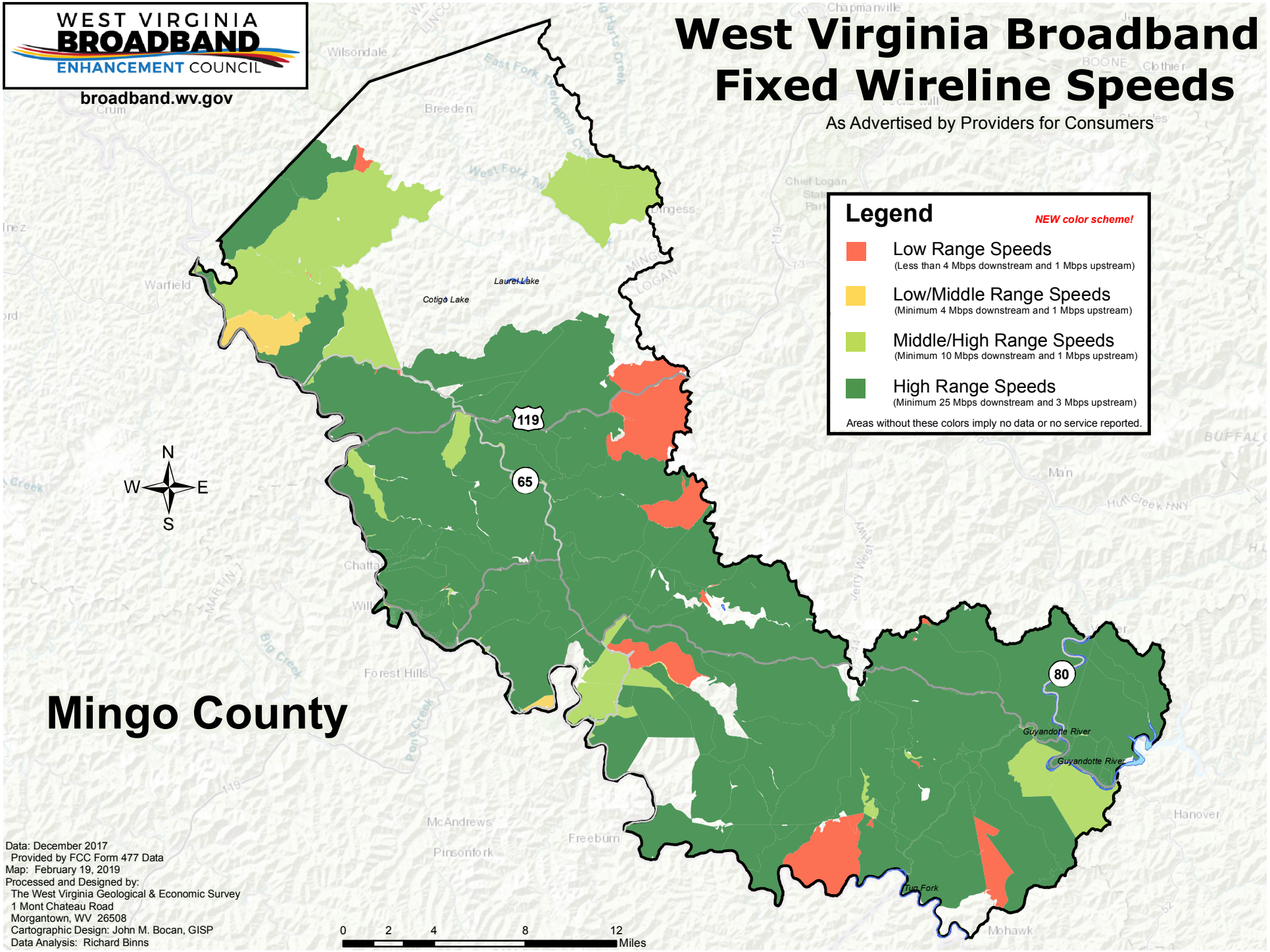
Note: ADSS stands for All Dielectric Self Supporting (Fiber Optic Cable)

WEST VIRGINIA BROADBAND ENHANCEMENT COUNCIL

broadband.wv.gov

West Virginia Broadband Fixed Wireline Speeds

As Advertised by Providers for Consumers



Mingo County

Data: December 2017
Provided by FCC Form 477 Data
Map: February 19, 2019
Processed and Designed by:
The West Virginia Geological & Economic Survey
1 Mont Chateau Road
Morgantown, WV 26508
Cartographic Design: John M. Bocan, GISP
Data Analysis: Richard Binns

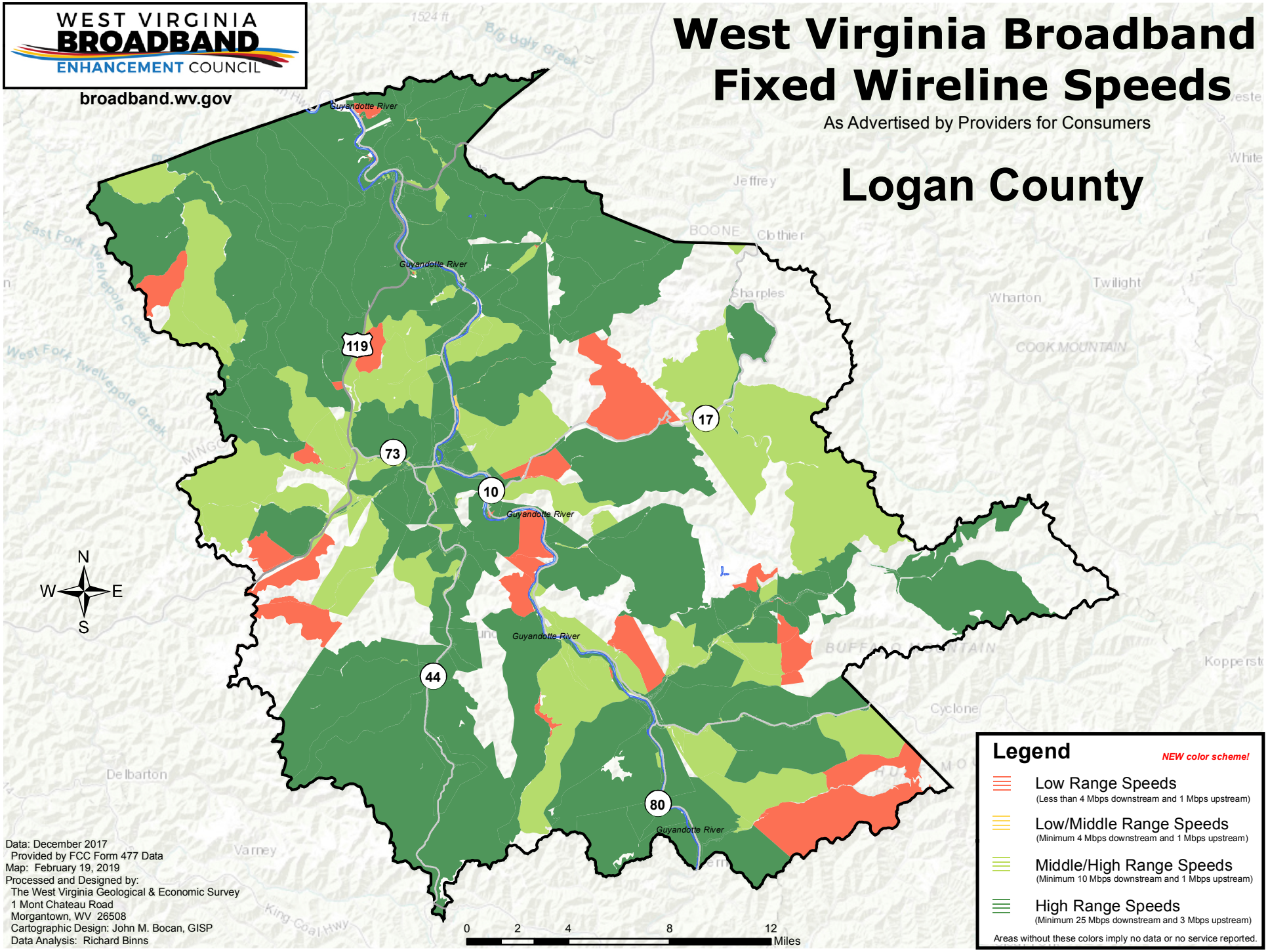
WEST VIRGINIA BROADBAND ENHANCEMENT COUNCIL

broadband.wv.gov

West Virginia Broadband Fixed Wireline Speeds

As Advertised by Providers for Consumers

Logan County



Legend

NEW color scheme!

- Low Range Speeds (Less than 4 Mbps downstream and 1 Mbps upstream)
- Low/Middle Range Speeds (Minimum 4 Mbps downstream and 1 Mbps upstream)
- Middle/High Range Speeds (Minimum 10 Mbps downstream and 1 Mbps upstream)
- High Range Speeds (Minimum 25 Mbps downstream and 3 Mbps upstream)

Areas without these colors imply no data or no service reported.

Data: December 2017
Provided by FCC Form 477 Data
Map: February 19, 2019
Processed and Designed by:
The West Virginia Geological & Economic Survey
1 Mont Chateau Road
Morgantown, WV 26508
Cartographic Design: John M. Bocan, GISP
Data Analysis: Richard Binns

Exhibit 2
Page 2 of 2

To Cabell County

Boone

Route 1 - "AMI" Route

Logan

Mingo

Wyoming

Pike

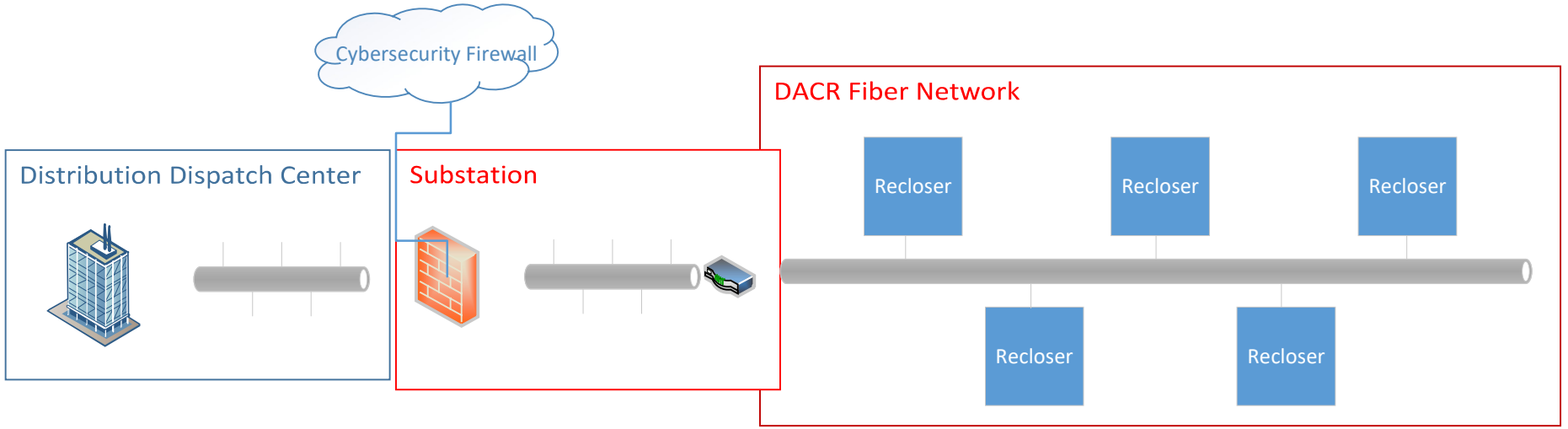
To McDowell County

Legend

State Line
New Fiber
County Line
Pre-approved Transmission fiber

Exhibit 3

"AMI" Route – Fiber to Substation and DACR Reclosers



"AMI" Route – Fiber to Substation and AMI Access Points

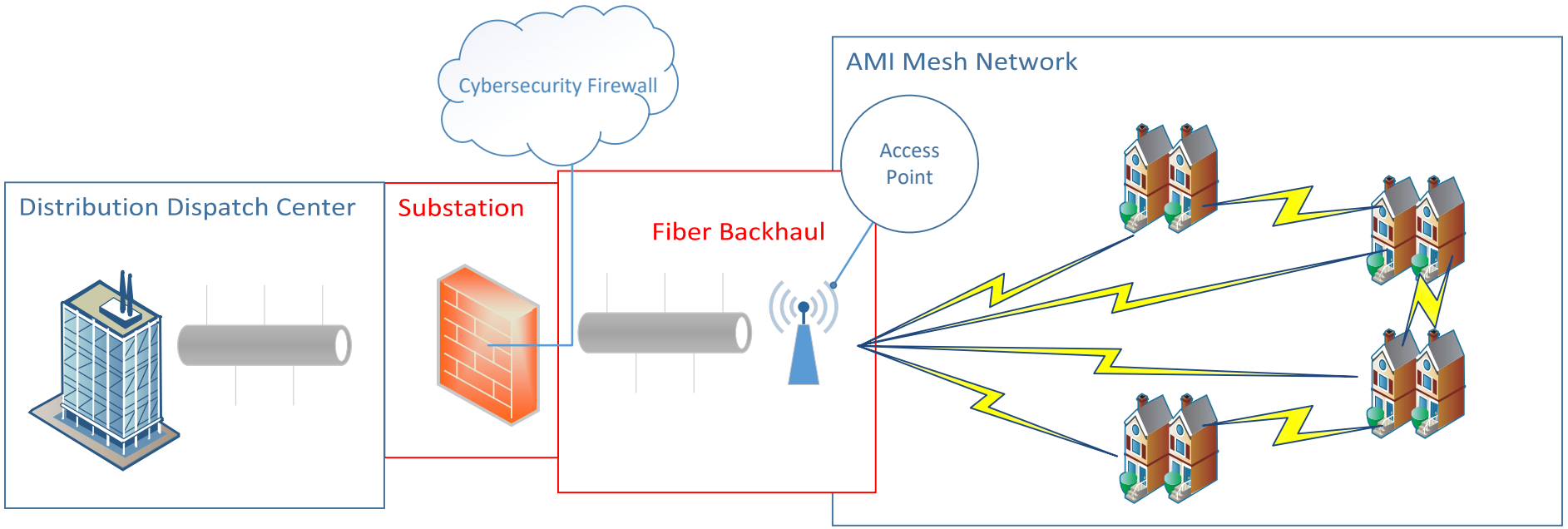


Exhibit 4

To Cabell County

Boone

Route 2 - "DACR" Route

artin

Mingo

Logan

Wyoming

Legend

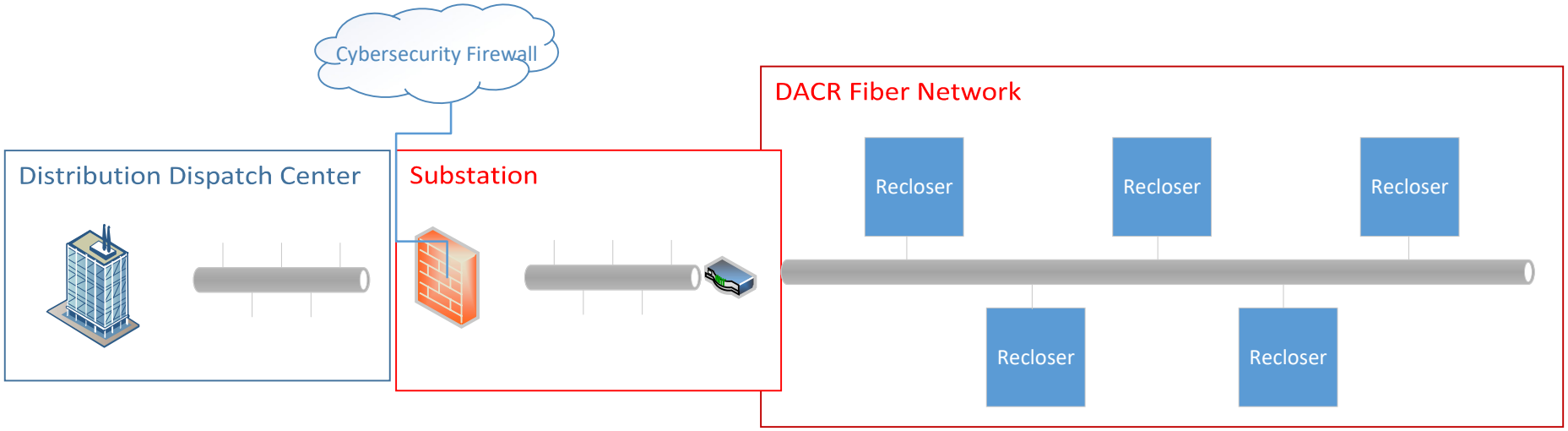
State Line
New Fiber
County Line
Pre-approved Transmission fiber

Pike

To McDowell County

Exhibit 5

"DACR" Route – Fiber to Substation and DACR Reclosers



"DACR" Route - AMI Wireless/Cellular Backhaul

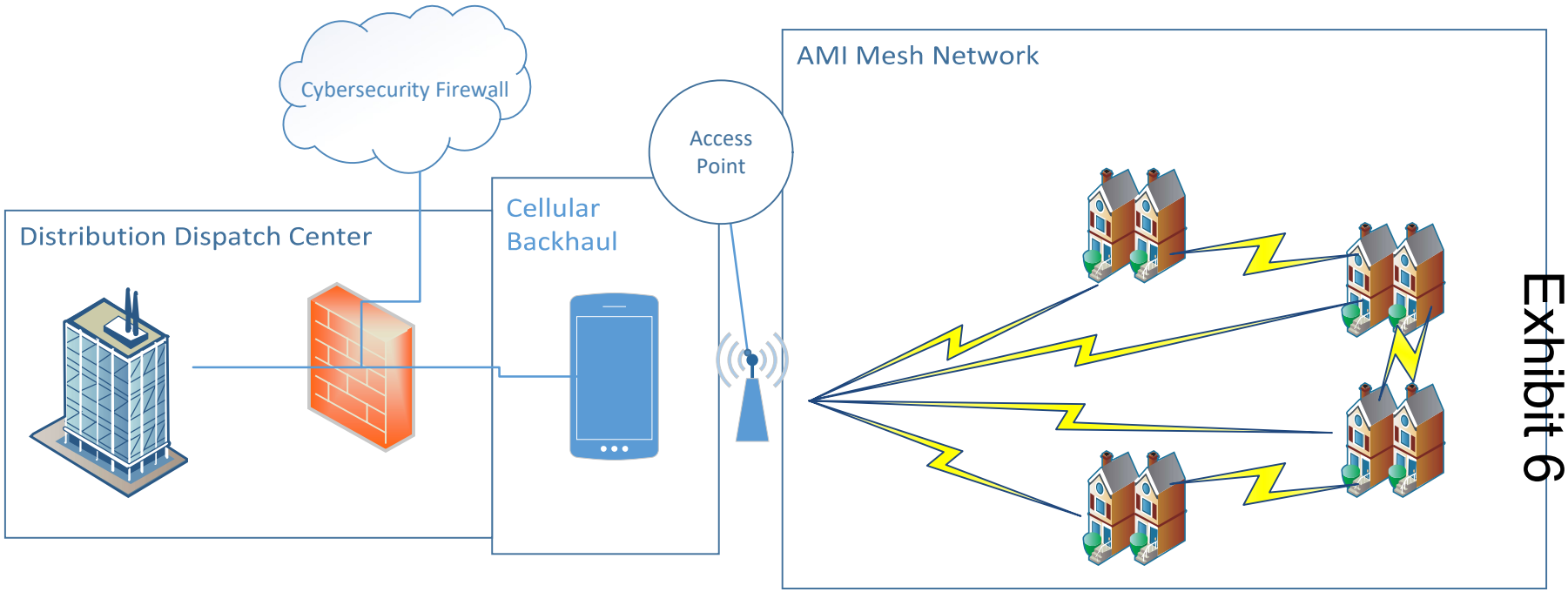


Exhibit 6

To Cabell County

Boone

Logan

Mingo

Wyoming

Pike

To McDowell County

Legend

State Line
New Fiber
County Line
Pre-approved Transmission fiber

Route 3 - "Substation" Route

Exhibit 7

Logan and Mingo County - Route 1

(in millions)	First Year
Capital (30 Year Life)	48.06
Capital (10 Year Life)	6.52
Accumulated Depreciation	(2.25)
Rate Base	52.33
Return and Income Tax (Pre-Tax WACC)	4.61
Depreciation	2.25
Annual O&M	1.77
Property Tax	0.17
Revenue Requirement	8.81

Depreciation Expense (in millions)	
Capital (30 Year Life)	1.60
Capital (10 Year Life)	0.65
	2.25

Project Cost Assumptions (in millions)	
Capital (30 Year Life) Fiber	39.93
Capital (30 Year Life) Pole Replacement	8.13
Capital (10 Year Life)	6.52
Property Tax on Fiber and Equipment	0.319%
O&M (as a % of Capital Costs)	3.250%

First Year Revenue Requirement	8,810,000	
Billing Determinants	5,163,250,373	
	Monthly Cost	**Annual Cost**
Residential 1000 kWh customer	$ 1.13	$ 13.51

Logan and Mingo County - Route 2

(in millions)	First Year
Capital (30 Year Life)	30.48
Capital (10 Year Life)	4.00
Accumulated Depreciation	(1.42)
Rate Base	33.07
Return and Income Tax (Pre-Tax WACC)	2.91
Depreciation	1.42
Annual O&M	1.12
Property Tax	0.11
Revenue Requirement	5.56

Depreciation Expense (in millions)	
Capital (30 Year Life)	1.02
Capital (10 Year Life)	0.40
	1.42

Project Cost Assumptions (in millions)	
Capital (30 Year Life) Fiber	25.68
Capital (30 Year Life) Pole Replacement	4.80
Capital (10 Year Life)	4.00
Property Tax on Fiber and Equipment	0.319%
O&M (as a % of Capital Costs)	3.250%

First Year Revenue Requirement	5,560,000	
Billing Determinants	5,163,250,373	
	Monthly Cost	**Annual Cost**
Residential 1000 kWh customer	$ 0.71	$ 8.53

Logan and Mingo County - Route 3

(in millions)	First Year
Capital (30 Year Life)	22.47
Capital (10 Year Life)	2.86
Accumulated Depreciation	(1.03)
Rate Base	24.29
Return and Income Tax (Pre-Tax WACC)	2.14
Depreciation	1.03
Annual O&M	0.82
Property Tax	0.08
Revenue Requirement	4.08

Depreciation Expense (in millions)	
Capital (30 Year Life)	0.75
Capital (10 Year Life)	0.29
	1.03

Project Cost Assumptions (in millions)	
Capital (30 Year Life) Fiber	19.17
Capital (30 Year Life) Pole Replacement	3.30
Capital (10 Year Life)	2.86
Property Tax on Fiber and Equipment	0.319%
O&M (as a % of Capital Costs)	3.250%

First Year Revenue Requirement	4,080,000	
Billing Determinants	5,163,250,373	
	Monthly Cost	**Annual Cost**
Residential 1000 kWh customer	$ 0.52	$ 6.26