

City of Pikeville, Kentucky

Request for Proposal

for

**Partnership for Fiber-to-the-Premises (FTTP) Network
Deployment**

Issued: November 23, 2016

Contents

I.	Introduction	1
II.	Procurement Goals	2
III.	The City’s Short- and Long-Term Vision.....	4
	The City’s Plan for Phase One	6
IV.	Background: The City of Pikeville.....	8
V.	City Contributions and Assets	11
VI.	Partnership Models.....	12
	Model 1: Infrastructure Public–Private Partnership.....	13
	Model 2: Dark Fiber Lease	14
	Model 3: Operational Contractor	14
VII.	Evaluation Criteria.....	15
VIII.	General Network Design and Construction Parameters	16
IX.	Technical Capabilities.....	17
X.	Operational Capabilities.....	18
XI.	RFP Response Requirements	20
XII.	Response Process.....	22
	Letter of Intent.....	23
	Questions	23
	Response Deadline.....	23
	Summary of RFP Process Deadlines.....	23
XIII.	Personal Presentations	23
	Appendix A: KMZ Map of Phase One Service Area.....	24
	Appendix B: Partnership Fiber Construction Standards	24
	1. General Requirements of Construction Services.....	24
	1.1. General Work Elements.....	24
	1.2. Work Standards and Quality	25
	1.3. Underground Cable Construction.....	26
	1.4. Fiber Laterals / City Service Drops and Inside Plant Construction	27

1.5.	Fiber Testing	28
1.6.	Engineering Redlines	30
1.7.	Material Handling	30
1.8.	Safety Documentation and Training.....	31
1.9.	Construction Safety and Health Standards	31
1.10.	Traffic Control and Work Area Protections	31
1.11.	Accident Reporting	33
2.	Fiber Construction and Maintenance Specifications.....	33
2.1.	Fixed Emergency Response Retainer Fee.....	34
2.2.	Underground Conduit and Cable Installation.....	36
2.3.	Aerial Fiber Installation.....	48
2.4.	Fiber Splicing and Testing	50
2.5.	Fiber Termination and Inside Plant Work	52
2.6.	Locating Services	58
3.	Network Electronics Requirements	59
3.1.	Optical Line Terminal (OLT)	63
3.2.	Optical Network Terminal (ONT).....	63
4.	Fiber Optic Broadband Service Requirements.....	64
4.1.	Residential Services	64
4.2.	Business Services	65
4.3.	Network Performance Standards.....	65

Figures

Figure 1:	Map of Proposed Phase One Service Area	7
Figure 2:	Typical City Roadway Repair Standards.....	27
Figure 3:	Typical Micro-Trench Detail.....	42
Figure 4:	High-Level FTTP Architecture.....	61

I. Introduction

The City of Pikeville, Kentucky (“City”) issues this Request for Proposal (RFP) to convey its interest in partnering with a motivated, high-caliber partner (“Partner”) to deploy a fiber-to-the-premises (FTTP) network capable of delivering Gigabit-class service in the region. The partnership will balance risk and reward between the parties to deploy the first phase (“Phase One”) of an FTTP network that will be expanded in subsequent phases throughout the region to eventually include the entire City of Pikeville, neighboring Coal Run Village, and additional portions of Pike County.

The City of Pikeville is a beautiful and exciting place to live, work, and visit. Home to numerous higher education institutions and a thriving business economy, Pikeville is a center for innovation and growth in Eastern Kentucky. With robust educational, financial, healthcare, hospitality, legal, and tourism sectors, Pikeville has universal appeal. City leadership is committed to ensuring that Pikeville continues to prosper and evolve as the global economy shifts, the job market changes, and the need for ultra-high-speed broadband access becomes increasingly evident.

The City aims to take advantage of the Commonwealth of Kentucky’s “KentuckyWired” initiative¹ to make affordable Gigabit-class broadband service available to all Pikeville businesses, homes, and community anchor institutions (CAIs). This procurement is intended to identify a capable Partner to work with the City to develop and deploy Phase One under one of the partnership models described in Section VI. The Partner will assist in coordinating efforts to gain important KentuckyWired middle-mile and backhaul access, and will strategically anticipate and plan for additional network implementation phases in the short- and long-term. The City anticipates a single contract with a Partner that will design, engineer, and construct the network in full.

The City seeks a dynamic Partner willing to invest in Pikeville, and flexible enough to work through the complex process of network planning, deployment, and operation and possible service delivery with the City. In return, we pledge to support and facilitate any necessary processes; access to community assets; access to the public right-of-way (ROW); assistance with permitting; and any other advantage we may be able to bring to the partnership.

The City has initiated this RFP to identify a Partner to enable or directly provide high-capacity broadband services over a fiber network to end users. Responses to this RFP should state how the Partner’s approach will successfully deploy Phase One, and will result in a financially sustainable business model that furthers the City’s goals. The City seeks input from potential partners regarding the terms and conditions under which they would participate in such a project; the estimated cost for Phase One; and the Partner’s short- and long-term plan for both network planning, engineering, and deployment and marketing and delivering services. We seek

¹ “KentuckyWired,” *KentuckyWired*, accessed November 3, 2016, <http://kentuckywired.ky.gov/Pages/index.aspx>.

a Partner that will share technological and operational responsibilities and financial risk between the public and private partners in innovative ways.

The ideal Partner will meet the City's goals in Section II and Section III, and will outline an approach to each of the potential partnership models described in Section VI. Responses will be evaluated using the criteria in Section VII. The City envisions a mutually beneficial, long-term relationship with its Partner, and seeks parties that are interested in becoming a part of our community.

II. Procurement Goals

The purpose of this RFP is to establish a contract with a Partner to develop and deploy an FTTP network in a select area of the City of Pikeville, known as Phase One (see the map in Figure 1, below, the KMZ file in Appendix A). Note that bidders should not feel limited by the map we have provided here—bids that are even more expansive, while still limiting City risk, will be viewed and scored favorably.

Ideally, through this contract, the partnership will also eventually expand the FTTP network to include additional portions of the City, neighboring Coal Run Village, and other portions of Pike County. The City envisions a long-term agreement with its Partner, and seeks to enter a 20- to 30-year contract.

Respondents to this RFP should indicate whether and how they will:

- 1.** Design, engineer, and deploy an FTTP network in the Phase One service area.
- 2.** Articulate a comprehensive plan for a variety of partnership models, as outlined in Section VI, including the cost to implement these plans and a breakdown of financial and operational risk to each party.
- 3.** Strategically market services and deploy FTTP to maximize return on investment (ROI) in the Phase One service area to enable deployment of additional phases, with an eventual goal of serving the entire region.
- 4.** Deliver an unfettered data offering that does not impose unreasonable caps or usage limits on one use of data over another (i.e., does not limit streaming). All application providers (data, voice, video, cloud services) will be equally able to provide their services, and the consumer's access to advanced data will open the marketplace.
- 5.** Balance financial risk to avoid imposing an undue economic burden on the City, and adapt to changing circumstances. While most critical infrastructure does not necessarily need to generate net revenue, the Partner's proposal must be based on a sustainable long-

term operating model. The City is likely to make substantial investments in network infrastructure and operations; in a successful partnership, both parties will have a financial stake in the network's success.

6. Enable open access to ensure that local businesses, CAIs, and residents can affordably connect to a very robust and reliable broadband network and are not subject solely to the commercial priorities of only one private ISP. The business model should accept, accelerate, and encourage competition among service providers. The Partner should describe how its proposal will enable multiple ISPs to provide service over the network, and outline its plan for guaranteeing that at least one anchor ISP will offer services to end users.
7. Provide device-neutral service to all users to ensure that the network is usable via all standard commercial devices.
8. Consider ways for the City and the Partner to share financial and operational risks.
9. In the long term, provide cost-effective services for price-sensitive customers and flexible pricing plans to help narrow the digital divide and ensure access to all City residents.

For the network to have the intended economic and quality-of-life impacts, we consider both cost and availability of service to be important. We encourage responses that address both to maximize service adoption. If the Partner will not act as an anchor Internet service provider (ISP), we ask that the response describe any partnerships with service providers, and potential pricing for a range of services that can meet the needs of a variety of users.

The City is in the process of seeking grant and other funding to begin deploying a phased FTTP network, which will be strategically designed to serve select portions of the community (see the map in Figure 1, below), and will focus on providing service to businesses, CAIs, and residential users in the Phase One service area. The City may request to work collaboratively with its Partner to determine how best to serve the Phase One service area, including but not limited to exact placement of infrastructure, timeline for network deployment, site prioritization, and customer acquisition plans.

The City anticipates that it will obtain grant funding for a portion of the network, and that it may supplement these funds with a bond, loan, or other public funding mechanism at the City level. Depending on its selected partnership model, the City expects the Partner to contribute financially to the partnership as well. The partnership will rely on the City and its Partner sharing the financial and operational risk of network implementation and operation.

While the City has not yet selected its preferred partnership model, respondents to this RFP should clearly articulate their ability and willingness to partner with the City under each of the partnership models described in Section VI. Additionally, respondents should indicate how their approach to each of these models may be impacted if the City can provide \$15 million of upfront funding to deploy our proposed Phase One service area (see Appendix A). The City will decide which partnership model to pursue, and which Partner best meets its needs, based in part on the result of this procurement process.

Respondents should be advised that the City seeks a flexible Partner, and will prioritize those responses that articulate a plan for each of the proposed models. Because the City may opt to pursue some combination of these models, it may be in our best practical interest to pursue a partnership with a Partner that successfully describes its ability to enter a partnership under any of the models. Responses that fail to articulate a clear plan under each of the proposed partnership models may be excluded from further review.

Section IX asks for the Respondent's technical capabilities, while Section X asks respondents to describe operational capabilities. Respondents should clearly articulate their capabilities, as described in these sections, and any additional information that illustrates their technical, operational, and other relevant abilities to successfully enter this partnership.

Respondents must be willing to provide projected costs for the partnership and FTTP deployment—including a breakdown that clearly shows the City's financial responsibility. Additionally, the Partner must be willing to adhere to the standards in Appendix B.

III. The City's Short- and Long-Term Vision

The City envisions world-class community communications infrastructure for Pikeville's businesses and residents, for the 21st century and beyond. Networks capable of delivering ultra-high-speed broadband are infrastructure as critical as roads, water, sewer, and electricity. Every home, business, nonprofit organization, government entity, and educational institution should have the opportunity to connect, and City leadership aims to facilitate that here. Providing equal and affordable access to communications infrastructure and service is essential to promoting equal opportunity in business, education, employment, healthcare, and all other aspects of day-to-day life.

Pikeville is a regional hub of growth and activity, with a steadily expanding population and flourishing economy.² The City is dedicated to collaborating with its talented residents, businesses, institutions, and organizations to advance Pikeville's standing in the regional and

² "Pikeville Demographics," *Kentucky Demographics by Cubit*, accessed October 21, 2016, <http://www.kentucky-demographics.com/pikeville-demographics>.

global economy through a commitment to developing robust connectivity in the region. Our goal is to begin by supporting businesses, CAIs, and residential customers in the Phase One service area, and to eventually expand from there as users purchase service and offset costs associated with developing, deploying, and maintaining the network.

Bringing next-generation, fiber-based broadband connectivity to Pikeville is important to lower business costs, attract and retain highly skilled residents, and create sustainable new jobs in an entrepreneurial economy, based on innovation and creativity. Robust residential and institutional connectivity will also expand opportunities for local students in K–12 and beyond, and enable more open government and civic engagement.

We intend to empower our citizens and local businesses to be network economy producers—not just consumers of network information and data services. Further, we intend to provide our stakeholders with the broadband capacity they need to compete successfully in the global marketplace.

Currently, access to reliable broadband connectivity in the region is sporadic, and many consumers must settle for minimal speeds at exorbitant prices. For an important portion of the community, even basic service is too expensive, potentially creating large opportunity gaps for some of the most vulnerable members of our community. With the reduction in coal jobs throughout Eastern Kentucky,³ and a Pike County unemployment rate of 11.30 percent⁴—more than double the national rate of 5.0 percent⁵—the City aims to take decisive steps toward ensuring its residents and businesses can keep pace with a changing economy.

City leaders recognize that a phased approach is likely necessary to realize the City’s long-term goal to deploy an FTTP network throughout the region, and to eventually connect unserved and underserved areas. To deploy Phase One to select areas in Pikeville where ROI may enable continued network growth, the City aims to obtain grant funds—which it may elect to supplement bond and other funding—and we ask for private investment from our Partner. This approach focuses on the area outlined in the map in Figure 1, and anticipates that an aggressive marketing plan will be necessary to attract business, CAI, and residential users.

The City aims to eventually expand the partnership to encompass additional parts of the region, and will work with the Partner to determine the service area in phases beyond the initial deployment. The City will rely on its Partner to identify any necessary modifications to its

³ Bill Estep, “Coal Jobs and Production Fell Sharply in Eastern and Western Kentucky in 2015,” *Lexington Herald Leader*, February 1, 2016, accessed April 21, 2016, <http://www.kentucky.com/news/state/article57684253.html>.

⁴ “Pikeville, Kentucky Economy,” *Sperling’s Best Places*, accessed October 24, 2016, <http://www.bestplaces.net/economy/city/kentucky/pikeville>.

⁵ “Bureau of Labor Statistics Data,” *Bureau of Labor Statistics*, accessed October 24, 2016, <http://data.bls.gov/timeseries/LNS14000000>.

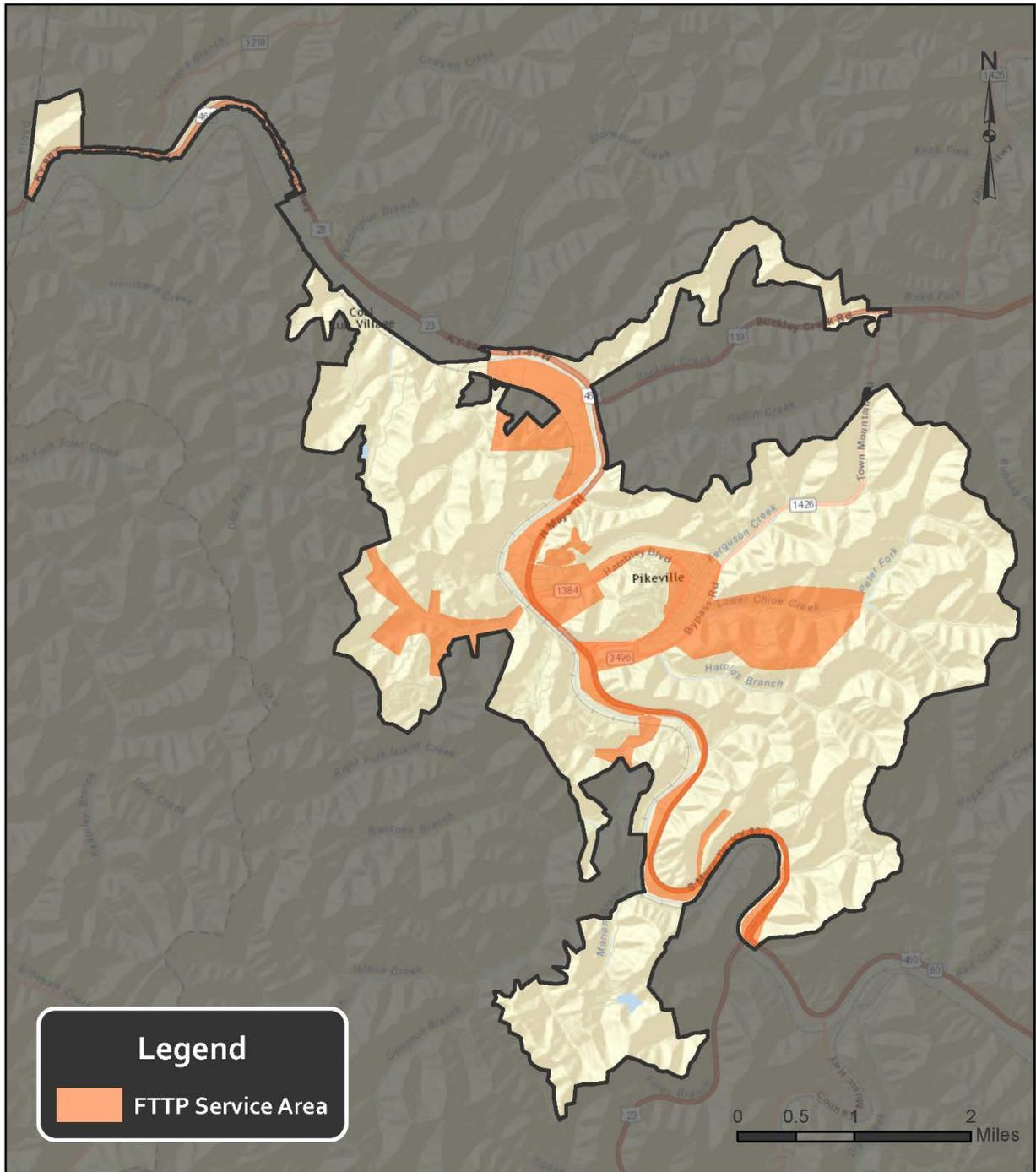
proposed Phase One service area, and to support successfully designing and engineering the network to support a targeted deployment to realize maximum efficiencies. The City expects the Partner's expertise to drive the marketing plan for service delivery, whether directly by the Partner or through one or more Internet service providers (ISPs) identified by the Partner.

The City's Plan for Phase One

Phase One of the City's multi-stage project will include constructing a fiber backbone in the selected service area—approximately 57 miles of distribution fiber that will pass 2,850 homes, businesses, and other community organizations that represent potential customers. Phase One will also include constructing a network "core" site that will aggregate traffic from the FTTP sites and house the network's routers that will allow for interconnection with other networks including the network's "upstream" connection to the Internet. Planning for upstream connectivity is a critical element of the partnership, and will require meaningful coordination between the City, the Partner, and the Commonwealth.

Figure 1 shows the proposed Phase One service area, which the City expects to work with the Partner to fully design, engineer, and deploy. Appendix A is a KMZ map that shows Phase One in greater detail.

Figure 1: Map of Proposed Phase One Service Area



Respondents must demonstrate an ability to design, engineer, and construct the proposed service area, and articulate a plan to provide service to the maximum number of potential customers in the service area. Additionally, Respondents must share projected costs associated with network deployment and service delivery, and should describe the City's financial and

operational risk. Respondents must also describe contingencies for various financial scenarios in which the City can contribute a range of public funding to the partnership, as outlined in Section VI.

IV. Background: The City of Pikeville

Nestled in the Appalachian Mountains in Kentucky's geographically largest county, Pikeville is a uniquely desirable place to live, work, and visit—a big little city with the comforts of small town life and the convenience of big-city living. With breathtaking landscapes, a rich tradition of resilience, and a fierce determination to stay economically relevant, the City of Pikeville and its nearly 7,000 residents—which is about 10 percent of the overall Pike County population—are constantly adapting to a changing world.⁶

The City's commitment to bring broadband connectivity to its residents and businesses is just another chapter in its history of doing whatever it takes to keep Pikeville on the map. The City is so dedicated to solving its own problems that it literally moved a mountain and rerouted a river to address frequent flooding in the area.⁷ The \$80 million project, known as the Pikeville Cut-Through, was the second largest earth removal project in U.S. history, and was completed in about 14 years through coordination among local, regional, and federal institutions.⁸

Over 50 percent of the total businesses in Pike County are in the City of Pikeville and our contiguous neighboring city of Coal Run Village. The largest employer in the City is the Pikeville Medical Center, Kentucky's only Level II Trauma Center. It is a 300-bed facility that employs approximately 2,500 staff and 350 health care providers,⁹ and is associated with the Mayo Clinic and Cleveland Clinic.¹⁰ It also houses the Heart and Vascular Institute¹¹ and the Leonard Lawson

⁶ "Pikeville, Kentucky profile," *City Data*, accessed March 3, 2016, <http://www.city-data.com/city/Pikeville-Kentucky.html>.

⁷ "Pikeville: The City That Moved a Mountain," *Amusing Planet*, accessed October 27, 2016, <http://www.amusingplanet.com/2015/11/pikeville-city-that-moved-mountain.html>.

⁸ "Pikeville Cut-Through Project," *Tour Pike County*, accessed April 28, 2016, http://www.tourpikecounty.com/things-to-see-do/outdoor_adventure/pikeville-cut-through-project/.

⁹ "Pikeville Medical Center," *Pikeville Medical Center*, accessed October 27, 2016, <http://www.pikevillehospital.org/>.

¹⁰ "Pikeville Hospital Becomes Affiliate of Cleveland Clinic," *Lexington Herald Leader*, accessed November 1, 2016, <http://www.kentucky.com/latest-news/article44074725.html>.

¹¹ "Heart and Vascular Institute," *Pikeville Medical Center*, accessed November 1, 2016, <http://www.pikevillehospital.org/services/heart-and-vascular-institute/>.

Cancer Center,¹² and is routinely recognized for outstanding patient care and community outreach efforts.¹³

The Pike County Board of Education is the second-largest employer in the City.¹⁴ The Pike County School District has the sixth-largest enrollment in the state, and comprises 25 educational facilities consisting of K-12 and vocational school programs.

As the Pike County seat, the City is the County's center for local, regional, and federal government activities. Pikeville is home to the Pike County courthouse, which offers services ranging from family court to motor vehicle licensing.¹⁵ The Eastern District of Kentucky district court has a divisional office here,¹⁶ which houses the U.S. Court of Appeals and the U.S. District Attorney for the region. Pikeville also has a Federal Bureau of Investigations (FBI) office, which serves as the resident agency for nine counties,¹⁷ and a U.S. Marshals Services location.¹⁸

The City's history is steeped in the coal mining industry, though other industries have also taken root and thrived here—including the banking and legal industries, which followed coal. Pikeville has the third-largest banking industry in the state, following Louisville and Lexington—both large cities with more than 30 times our population. As coal jobs diminish, Pikeville residents are taking steps to ensure that our economy stays strong through initiatives like Bit Source, a training program aimed at teaching coal miners to write computer code so they are marketable as programmers.¹⁹

The City is also home to the University of Pikeville (UPIke), a private nonprofit institution with degree programs ranging from the associates level through doctoral degrees; the university has a strong focus on liberal arts education and healthcare programs—including the Elliott School of Nursing, the College of Optometry, and the College of Osteopathic Medicine. UPIke is also home

¹² "Leonard Lawson Cancer Center," *Pikeville Medical Center*, accessed November 1, 2016, <http://www.pikevillehospital.org/services/leonard-lawson-cancer-center/leonard-lawson-cancer-center-physicians/>.

¹³ "Awards and Recognitions," *Pikeville Medical Center*, accessed November 3, 2016, <http://www.pikevillehospital.org/about-pikeville-medical-center/awards-recognitions/>.

¹⁴ "Pike County Major Employers," *Big Sandy Regional Industrial Development*, accessed March 17, 2016, <http://www.bsrida.org/index.php?page=pike-county>.

¹⁵ "Pike County Services," *Pike County Clerk*, accessed May 3, 2016, <http://pike.clerkinfo.net/index.php/services>.

¹⁶ "Pikeville | Eastern District of Kentucky," *United States District Court Eastern District of Kentucky*, accessed April 28, 2016, <http://www.kyed.uscourts.gov/?q=content/pikeville>.

¹⁷ "FBI – Territory/Jurisdiction," *Federal Bureau of Investigation*, accessed April 28, 2016, <https://www.fbi.gov/louisville/contact-us/territory-jurisdiction>.

¹⁸ "U.S. Marshals Service, Courthouse Locations," *U.S. Marshals Service*, accessed April 28, 2016, <http://www.usmarshals.gov/district/ky-e/locations/>.

¹⁹ "Appalachian Miners Are Learning to Code," *Bloomberg Technology*, February 2, 2016, <http://www.bloomberg.com/news/articles/2016-02-03/from-coal-to-coding-appalachian-miners-getting-a-fresh-start>.

to the Coleman College of Business, which supports undergraduate and Master of Business Administration degrees, as well as a “startup challenge” program that is open to anyone in Eastern Kentucky.²⁰

Big Sandy Community and Technical College (BSCTC) has a branch in Pikeville and offers a range of certificates and two-year degree programs. Big Sandy also has a “Workforce Solutions” program geared toward developing marketable skills to enter the workplace; among its variety of training options is the Certified Fiber Optic Technician program.²¹

The City has a cozy, hometown feel with big-city amenities, including luxurious hotels, a 10-screen movie theatre,²² charming bed and breakfast lodging, and innovative local cuisine in locally-owned restaurants.²³ Pikeville boasts a broad range of industries, and there is no shortage of interesting activities in the area—everything from catching a live music show, to taking a zip-line tour with gorgeous mountain views, to whitewater rafting, to teeing off on an 18-hole golf course, to horseback riding, to visiting the Stone Heritage museum.

The City’s “Hillbilly Days” is the second-largest festival in the state, and has been a tradition for nearly four decades; the festival, which features a carnival, music, food, and fun, raises funds for the Shriners Hospital for Children in Lexington.²⁴ Pikeville is also home to the Eastern Kentucky Expo Center, a Commonwealth of Kentucky-owned multi-purpose arena that seats up to 7,000.²⁵

In 2015, the City secured nearly \$5 million in grant funding to support technology-based training and degree programs in the region. This included \$1 million in grants to build a Broadband Technology Center on the Pikeville campus—\$500,000 from the Appalachian Regional Commission (ARC) and \$500,000 in the form of a U.S. Housing and Urban Development (HUD) Community Development Block Grant. The Center will become the training site for the Fiber Optic Technician program and other technology-based training and degree programs.

The City of Pikeville provides a full range of services to its citizens—we own and operate our own gas, sewer, water, and trash collection utilities, and provide robust public safety services such as

²⁰ “CCOB – University of Pikeville,” *University of Pikeville*, accessed April 28, 2016, <http://www.upike.edu/Colleges/CCOB/>.

²¹ “Upcoming Training,” *Big Sandy Community & Technical College*, accessed March 3, 2016, http://www.bigsandy.kctcs.edu/en/workforce_solutions/upcoming_training.aspx.

²² “Riverfill 10,” *Riverfill 10*, accessed May 3, 2016, <http://riverfillten.com/>.

²³ “The 10 Best Pikeville Restaurants in 2016,” *Trip Advisor*, accessed April 28, 2016, https://www.tripadvisor.com/Restaurants-g39748-Pikeville_Kentucky.html.

²⁴ “Hillbilly Days 2016,” *Tour Pike County*, accessed March 3, 2016, <http://www.tourpikecounty.com/event/hillbilly-days-2016/>.

²⁵ “Arena Info,” *East Kentucky Expo Center*, accessed March 3, 2016, <http://www.eastkyexpo.com/ArenaInfo.aspx>.

police, fire, and emergency management. The City has also invested close to \$50 million in a new sewer plant and a new 400-acre industrial site that will be completed in October 2016.

The City intends to attract new industries to help diversify the economy, including allocating part of the Marion Branch Industrial Site for an Information Technology (IT) park. The Marion Branch features a new industrial designed road, bridge, utility transmission lines and million-gallon water tank, and has been selected as the leading industrial development site in Eastern KY.

The City's numerous local medical and technical industries will likely continue grow. Robust, citywide connectivity will support growth in new and burgeoning high-tech industries. The expertise to advance these and other industries already exists in Pikeville, and the City's goal is to nurture an environment conducive to economic expansion.

There are several communications service providers in the City, including AT&T, Birch Communications, Gearheart Communications, and Inter Mountain Cable. Indications are, however, that the local appetite and need for greater and more uniformly available broadband services, both now and in the future, cannot be met with current service levels.

V. City Contributions and Assets

The City recognizes that access to broadband is necessary in Pikeville to support our residents' and businesses' participation in a global economy. Considering this reality, the City is seeking grant funding to cover the cost of a portion of the Phase One deployment. The City may continue to pursue funding opportunities throughout the life of the partnership, and will do everything in its power to enable efficiencies for the public and private sectors.

Additionally, the City anticipates that it may contribute financially to the partnership through bond, loan, or other funding mechanisms to support fiber deployment. The City may also contribute to the ongoing partnership operations, and will work with the Partner to determine the most mutually beneficial approach to achieving this. The City's ability and willingness to commit to financial risk relies on balancing this and other risks with its Partner; respondents that are not willing to share risk may be excluded from further review.

Because the City has not yet selected a business model, we have not yet determined exactly what the City's role or level of involvement will be in the practical and operational aspects of the partnership. At a minimum, the City anticipates that it will be necessary to assign a point of contact for the Partner and/or its contractor(s), and we commit to providing services to help prevent or lessen conflicts in the Partner's construction schedule. City staff will be prepared to help the Partner navigate necessary permitting to streamline planning and construction efforts.

Once we have selected our Partner, the City is prepared to promptly move forward with the partnership and work through the details of the chosen partnership model. The City will work

with its Partner to facilitate the smoothest possible access for network construction and installation.

For the selected Partner, the City will provide access to non-public data resources that identify City infrastructure and, where available, access to existing conduit infrastructure. Such information includes but is not limited to traffic, sewer, water, and storm-drainage facilities. Conduit size and available capacity vary.

Respondents should also identify any existing assets they may have in the Pikeville area and how they intend to leverage those for this project. Partners may be asked to pay franchise fees to the City and pole attachment fees to the appropriate utility. Respondents should consider whether they propose to offset the fees with in-kind contributions, including conduit and dark fiber. The City will work with its selected Partner to facilitate conversations and collaboration between the partnership and pole owners such as Kentucky Power.

VI. Partnership Models

Though the City has a vision for potential partnership models that may make sense here, we have not yet determined which partnership model is most attractive to meet our needs. City leadership will rely, in part, on responses to this RFP to help make that decision, within the parameters of the partnership models outlined here. Further, the City may pursue a combination of these models, or use components of responses to develop a path forward that best fits our unique situation.

We ask that the Partner describe in detail costs associated with each model. For Model 1 and Model 2, we ask that the Partner detail when and how the network will become cash-flow neutral, and when it is expected to become cash-flow positive. Because growth into the remainder of the community relies on significant enough ROI to support additional network construction, it is important for the Partner to have a plan to address this and further the City's vision.

Potential partners may suggest alternative business models, but preference may be given to those respondents that clearly describe plans and associated projected costs for the three core business models described here. The City envisions three potential approaches to partnership, which are described in greater detail below. These models are:

- Model 1: Traditional Infrastructure Public–Private Partnership
- Model 2: Dark Fiber Lease
- Model 3: Operational Contractor

As we noted, the City may seek a combination of grant and other funding to support FTTP deployment. We ask that respondents describe a plan for each of the proposed business models under the assumption that the City will be able to invest \$15 million up front, through grant and bond funds. That is, respondents should describe how such upfront funding might impact their approach to each business model, as well as any potential increase in the service area footprint and number of potential customers in the Phase One service area (see attached KMZ in Appendix A).

The City will evaluate each respondent's proposed approach to each business model based on the framework described in Section VII.

Model 1: Infrastructure Public-Private Partnership

In the City's vision of a traditional infrastructure public-private partnership, also known as a "PPP" or "P3" model, the City and its Partner will enter a long-term contract where the Partner will use its expertise and private industry strengths to deliver a "turnkey" solution to the City. While the City will contribute to the project any grant funds it can secure, we anticipate that this model would not require bond or other City financing, but would rely on the Partner to provide private capital for network planning, engineering, and deployment—as well as marketing, customer acquisition, and service provision and delivery.

The City's Partner in this model takes a very active role from start to finish. While the City will not be "hands off," it will rely heavily on the Partner for its expertise to manage all functional and operational aspects of the partnership, ranging from network deployment to service delivery. The City will focus on process efficiency and contributing any resources it can to the partnership, and will rely on the Partner to bring its strategic, design, planning, engineering, deployment, and operational expertise to build the Phase One FTTP network.

Additionally, the Partner will be the City's agent in the community, and will be responsible for marketing and sales to encourage potential subscribers to purchase services from the partnership. The City will support the partnership by communicating with the community and backing the Partner as an established, trusted entity in the community.

The Partner may rely on other companies as its contractors for various parts of network planning and deployment, and service delivery. Respondents should clearly indicate what tasks and responsibilities it plans to perform itself and what tasks and responsibilities will be performed by other entities. If the Respondent will not directly act as an anchor ISP to ensure that at least one provider offers services over the network, the Respondent must indicate its plans to partner with other service providers.

Model 2: Dark Fiber Lease

As we noted, the City is in the process of seeking grant funding to assist in network construction. The City may opt to itself deploy a dark fiber network, which it would then lease to a Partner that would activate the fiber and offer services over it. In this model, the Partner may pay a per-passing fee to the City for use of the fiber or a combination of per-passing fee and share of revenues. The City would be responsible solely for fiber construction and maintenance, and the Partner would procure, own, and manage all equipment and functions from Layer 2 of the network on up, including all network electronics, customer premises equipment (CPEs), and customer contracts.

The City asks that respondents indicate rates they might pay for access to a City-owned dark fiber network, and under what terms. We are willing to consider a range of options under this model, including providing access on a flat-fee basis, on a revenue-share basis, or a combination of the two. The key to success in this model is that the Partner can articulate a clear plan for quickly lighting the fiber and beginning to offer services over it, and outline a sustainable business model that will help produce the ROI necessary to enable network growth.

In this model, the outside plant (OSP) infrastructure belongs to the City, and the City would own and maintain the fiber network. The Partner should indicate what financial, operational, and other expectations it might have of the City under such a model—in addition to constructing and maintaining the network.

Model 3: Operational Contractor

The City may elect to bid the project like other public works construction projects, where the winning bidder agrees to certain specifications to design, engineer, deploy, and operate infrastructure. The City currently relies on a contract with a private entity to deliver utilities services like water, sewer, and garbage collection, and this contract may operate like the City's other utilities contracts.

In this model, the Partner would not take direct operational or financial risk, but would instead act as the City's agent for managing network planning, implementation, and operation.

In this model, the Partner may not directly offer services to end users. Rather, the City may contract with one or more ISPs to market retail services and provide Internet service to business, CAI, and residential users. If the Partner has any expertise in this area, or has existing relationships with ISPs, the City encourages the Partner to disclose this and articulate a plan for taking advantage of those relationships or that expertise in this partnership.

It may be desirable for the City to rely on its Partner to act as an anchor service provider; alternatively, the Partner could contract with one or more ISPs to carry out this function. This

scenario would provide a safety net in the event that the City was unable to attract numerous ISPs to serve end users in Pikeville, consistent with our long-term open-access approach.

VII. Evaluation Criteria

The City understands that this is an unusual RFP that asks for proposals under several different business model scenarios. Given the newness of broadband public-private partnerships—especially concessionaire-style P3s—there do not currently exist adequate models for RFPs that seek these arrangements. Thus, this is a pioneering document. The City’s ideal Partner will be inspired to consider this unique procurement process an opportunity for innovation and collaboration toward a mutually advantageous, singular partnership model.

The City has opted to issue this RFP with three (3) business model options to cast a wide net and to obtain the highest possible number of partnership proposals from which to choose. Our hope is that this approach will provide us with the best set of choices, given the newness of partnerships and applying a P3 structure to broadband deployments.

We understand that there are a range of ways in which potential partners can bid, and we encourage respondents to select the model(s) that they think are best suited to their capabilities, and to bid accordingly.

The City will evaluate the responses based on the following general criteria:

- 1) The response’s viability, and the likelihood that the respondent will be able to meet the City’s policy goals for this initiative over time.
- 2) The level of financial risk that the response requires the City to take in the short, medium, and long term.
- 3) The number of Pikeville businesses, CAIs, and residents that will have the potential to purchase service under the respondent’s bid for the Phase One service area.
- 4) The bidding entity’s track record with respect to construction, operations, and sustainability of communications networks.
- 5) The bidding entity’s financial stability and capitalization.
- 6) The bidding entity’s experience and depth of relationships in Eastern Kentucky.

The City will use internal quantitative and qualitative measures to evaluate each of the responses with these six (6) key evaluation criteria as a guide. The score “weight” applied to each of these criteria is listed in Table 1, below.

Table 1: Evaluation Criteria and Scoring

Evaluation Criteria	Scoring Percentage
1) Bid viability and policy goals	20%
2) Financial risk to the City	30%
3) Number of potential customers	20%
4) Partner track record	10%
5) Partner financial stability and capitalization	10%
6) Partner experience and relationships in Eastern Kentucky	10%

VIII. General Network Design and Construction Parameters

The City expects respondents to perform network construction and installation. The City will dedicate resources to support its Partner through plan review, coordination, and inspection services to assure an expedited approach to construction and installation in the public ROW and will work with the Partner to facilitate work.

The following baseline technical attributes are required:

1. Fully fiber-based connectivity to business, CAI, and residential users alike.
2. Fiber strand capacity capable of providing direct homerun connections to businesses and non-commercial high-volume users.
3. Fiber strand capacity and physical architecture (e.g., handhole placement, backbone routes, etc.) anticipating full deployment to all homes and businesses.
4. Low latency.
5. Backbone topology capable of supporting connections over diverse paths from one or more central hub locations to fiber distribution cabinets located throughout the City to facilitate high-availability service offerings.
6. Fiber distribution plant placed in underground conduit (as opposed to direct burial cable) to more readily facilitate repairs and capacity upgrades.
7. Aerial fiber distribution plant constructed on utility poles where beneficial.
8. Active components placed in environmentally hardened shelters and/or cabinets equipped with backup power generation and/or batteries, as appropriate, capable of sustaining services in the event of extended power outages.
9. Fiber path diversity to public facilities to maintain continuous service even if one path is broken.

10. Underground communications conduit pathways that can be utilized by the City for future scalability.
11. Fiber routes that are aligned with existing City conduit and coincide with planned City utility, roadway, and related capital improvement projects to reduce cost and minimize disruption where possible.

IX. Technical Capabilities

Some Respondents may already have all the staff and resources necessary to successfully carry out responsibilities in a partnership, while others may need to ramp up to meet the City's needs, and some may work through additional contractors. Whether directly or through contracts with competent vendors, what matters is that the Partner can perform the functions they have promised to carry out.

Respondents shall provide the following technical capabilities:

1. Number of years of experience as a facilities-based provider.
2. The mileage of OSP it currently operates, any previously owned and operated plant, and the type of infrastructure (e.g., coaxial, copper, FTTP, middle mile).
3. The size of the technical team and breakdown of experience level of the members—including network engineers that will be dedicated to monitoring the network's health, and staff that will be dedicated to OSP responsibilities.
4. Resumes of key technical management to be assigned to the project, and an organization chart specifying actual assigned individuals and their title. This should include the number and type of technical staff, and the approximate allocation of each to this effort during each key phase of deployment.
5. Formal relationships, such as distribution and resale, with manufacturers of network equipment, fiber plant materials, and software. This might include:
 - 5.1. Level of relationship, if applicable (e.g., Cisco Gold Partner);
 - 5.2. Any corporate certifications from applicable manufacturers; and/or
 - 5.3. Sales and training certifications from applicable manufacturers.
6. Any examples of network implementations and/or construction of similar scope, and how recently this was completed. This should include:
 - 6.1. Areas of the required work the Partner can self-perform, particularly in the case of construction tasks;
 - 6.2. Any established relationships with contractors and subcontractors relevant to the execution of this effort; and
 - 6.3. Specific roles of proposed contractors and subcontractors in the deployment.
7. Location of network operations center (NOC), and capabilities and functions of the NOC.

8. An inventory of all construction and network test equipment to be used in network deployment and ongoing maintenance (where applicable).
9. An inventory of all software and other programs the Partner will use to manage the network deployment and maintenance (e.g., GIS software, network monitoring software, etc.).
10. An explanation of how the Partner will perform locating services, and the names and qualifications of any proposed contractors that will assist with this.
11. A detailed explanation of how the proposed technical approach meets the partnership's functional and policy objectives. At a minimum, this should:
 - 11.1. Explain how the Partner provides sufficient ownership and/or control over network infrastructure to ensure that capacity, security, and reliability requirements can be met both in the short term and long term.
 - 11.2. Describe the technical restrictions the Partner will place on the use of the network for non-governmental, commercial purposes (where applicable).
 - 11.3. Explain how the approach allows for expansion or shifts in priorities as the project unfolds.
12. A project management plan that shows the Partner can identify key areas of risk to the project timeline and implementation success. Some details of this might include:
 - 12.1. ROW agreements, easements, available real estate;
 - 12.2. Historical and environmental permitting; and
 - 12.3. Material supply.
13. A quality control plan that demonstrates a commitment to quality, including any staff members that are accredited in some form of Quality Control, and any dedicated staff or departments for quality control and training. The plan should describe how the Partner will analyze errors and accidents, and perform root-cause analysis. It should also outline how and when the Partner will determine to take corrective action.
14. An account of the Partner's commitment to worker safety during construction. This might include items like a formal safety plan, inspection plans, and safety training.
15. A customer service commitment for installation to bring service to a customer's premises, including written policies that guide customer and staff interactions, outline acceptable industry-standard practices, and demonstrate the Partner's willingness to make the installation process positive for all customers.

X. Operational Capabilities

Respondents must clearly explain long-term operational plans.

1. A description of where and when the Partner has successfully maintained retail, wholesale, and dark fiber operations in other markets. In the absence of a demonstrated track record, the Partner should provide a very detailed outline of why it believes it can

be successful, and what its contingency plans will be if it cannot achieve the partnership's goals.

2. Examples of market share the company has obtained in other markets, and how long it has operated in those markets to achieve that share.
3. A description of the marketing plans and tools the Partner intends to use for the initial deployment, when customer acquisition is especially important.
4. The ongoing marketing tools and platforms the Partner will use to continue to reach the community (e.g., local radio and television outlets, social media platforms, targeted online advertisements, print advertisements) over the duration of the partnership.
5. Educational and other outreach efforts the Partner will use to demonstrate the power of a gigabit-capable network.
6. Names and capabilities of any outside firm(s) the Partner will engage for marketing, advertising, and operations.
7. Resumes of key operational management to be assigned to the region, and an organization chart specifying actual assigned individuals and their title. This should include the number and type of executive and managerial staff.
8. The size of the long-term technical team and breakdown of experience level of the members, including network engineers that will be dedicated to monitoring the network's health, and staff that will be dedicated to OSP responsibilities (where applicable).
 - 8.1. If the Partner will not directly employ network and OSP staff, it should articulate how it will monitor the network, manage outages, and effect timely repairs.
9. The long-term plan for fiber locating and splicing, including whether these responsibilities will be maintained in-house or contracted. If contracted, the names and qualifications of the firm(s) that will be engaged for this.
10. Existing or newly established relationships the Partner may have within the community, relationships it envisions, and how it will cultivate and maintain those (e.g., will the Partner become a member of the Chamber of Commerce or other community organizations?) Demonstrate that it will invest in the community because it plans to maintain a long-term presence.
11. The location and capability of the customer call center for all customers, ranging from retail to dark fiber (where applicable). The Partner should be able to demonstrate that it can meet all customers' needs in a timely, complete, and satisfactory manner.
12. Invoicing policies, including when and how the full range of customers are invoiced, and whether there are options available to meet all customers' needs (e.g., online billing or paper invoices).
13. The number (and location, when possible) of local retail storefront offices where a customer can "see" the Partner in action. The Partner should outline what services will be available to customers at these locations.

14. An account of the Partner's intention to hire permanent local marketing, sales, billing support, customer support, technical support, and other staff—or justification for choosing not to do so.
15. A hierarchical flowchart of all operations staff, both remote and local.
16. Sales objectives in the first 1, 2, and 3 years as the project ramps up. Sales objectives in years 5, 7, and 10. While it is difficult to project many years into the future, the Partner should be able to outline that it has intentions of maintaining a strong presence in the region over the coming years, and that it is planning for the partnership beyond the initial deployment.
17. The Partner's expectations of the City to assist in marketing and advertising. The Partner should demonstrate how it intends to achieve the take rates necessary for the partnership to be successful, and whether and to what degree this plan will rely on City staff and resources.

XI. RFP Response Requirements

The City requests the following information—in as much detail as is practicable—from Respondents. All responses should adhere to the following response requirements and page requirements. All responses should follow the order and structure of the requested information, including all numbering as indicated.

Page requirements are based on Times New Roman or Calibri 12-point font with 1" margins on all sides. Start a new page for each response header. Responses that do not follow this format may be excluded from further consideration.

Please provide your electronic response in Microsoft Word or Adobe PDF format, based on the following response structure and numbering:

1. **Cover Letter:** Please include company name, address of corporate headquarters, address of nearest local office, contact name for response, and that person's contact information (address, phone, cell, email). Keep response to one (1) page.
2. **Business Model Summary:** Summarize the business model you intend to use for the partnership. This should be a concise explanation of the key components of your business model, including but not limited to the division of network and operations responsibility and ownership. Keep response to two (2) pages.
3. **Affirmation:** Affirm that you are interested in this partnership and address the core project goals and network design parameters listed above (Sections V and VI). List each goal and requirement with a brief statement of how you will comply. If you cannot meet

any of those requirements, indicate the requirements to which you take exception, and provide an explanation of the exceptions. Keep response to three (3) pages.

- 4. Experience:** Provide a statement of experience discussing past performance, capabilities, and qualifications. Identify other networks your firm has designed, built, maintained, or operated; include the levels of broadband speed, availability, and adoption among different categories of end users and unique capabilities or attributes. Discuss partnerships with other service providers, government, or nonprofit entities you have undertaken. Describe the nature of the projects and your firm's role. For entities currently providing communication services in or near Pikeville, describe your current service footprint in the City, including a description of the type of infrastructure and services you currently offer and the technology platform(s) used. Explain how your firm is a suitable partner for this project. Keep response to two (2) pages.
- 5. Technical Capabilities.** Using the guidelines in Section IX, describe your technical capabilities, and how they will make your firm an attractive Partner for this project. Keep response to three (3) pages.
- 6. Operational Capabilities.** Using the guidelines in Section X, describe your operational capabilities, and how they will make your firm an attractive Partner for this project. Keep response to three (3) pages.
- 7. Provide a proposed network diagram.**
- 8. Business Structure:** Summarize how you would execute a partnership under each of the partnership models described in Section VI. Under each of these models, what are the key assumptions? What are your main areas of risk, and how can the City help reduce the risks? What are the City's main areas of risk, and how will you reduce the risk to the City? If you are not equipped to provide a response for any of the City's partnership models, please note this and explain. Keep response to three (3) pages.
- 9. Open Access:** If you currently operate communications facilities, indicate whether they are operated on an open-access basis. Describe whether and, if so, how you would support open access infrastructure in the City. Keep response to one (1) page.
- 10. Schedule:** Describe your proposed schedule for implementing service. Offer a timeline with key milestones. Would you be able to begin service before the entire network is constructed? Keep response to two (2) pages (one for response, one for schedule).
- 11. Maintenance:** Depending on the City's selected partnership model, the Partner may be required to perform fiber network maintenance. Please describe your ability to perform

maintenance on an ongoing and as-needed basis. Provide estimates of the operating cost of maintaining the fiber optic outside plant for the Phase One network and include your main assumptions. Keep response to one (1) page.

- 12. Privacy:** Describe your ability to provide secure network service or infrastructure that complies with public safety and other security and privacy regulations and requirements. Keep response to one (1) page.
- 13. Financing and Funding:** Please provide a one-page flow chart that shows the flow of funds between all parties in your response. Include all sources and uses of funds. Please keep response to one (1) page.
- 14. Services:** Describe the service options you plan to offer over this network (for example, data only; voice and data; a triple play of voice, data, and cable television; etc.). What download/upload or symmetrical speeds would you offer and guarantee to end users? How will your residential and business offerings differ? What types of service level agreements (for lit services: availability and packet delivery; for dark fiber: repair time) would you be prepared to offer? Keep response to two (2) pages.
- 15. Pricing:** Provide your approach to pricing the proposed services. For managed services, please describe factors impacting non-recurring costs (estimated fiber path distances, equipment redundancy, etc.); recurring costs for varying capacity levels; and any key technical assumptions upon which prices are based. For dark fiber offerings, please describe desired pricing models. Keep response to two (2) pages.
- 16. Local Participation and Economic Development:** Provide a statement of how your proposed participation would help the City's economic development goals. Describe your interests and plans to hire local contractors and providers in Pikeville, and how your participation would help local job creation. Describe your relationships with local businesses in the City, if any, as well as your interest and plans to engage them in this project. Keep response to three (3) pages.
- 17. References:** Provide a minimum of three (3) references, including contact information, from previous contracts or partnerships. Keep response to two (2) pages.

XII. Response Process

Consistent with Commonwealth of Kentucky law, all correspondence regarding this RFP should be directed to the City Clerk:

Christy Billiter

Christy.billiter@pikevilleky.gov

The City cannot guarantee that correspondence directed to other City staff or departments will be received or considered.

Letter of Intent

All interested respondents are asked to submit a **non-binding** letter of intent via email by December 2, 2016 to Christy Billiter at Christy.billiter@pikevilleky.gov.

Questions

Questions related to this RFP should be emailed to Christy.billiter@pikevilleky.gov no later than **4:00 PM EST on December 9, 2016**.

Response Deadline

Final RFP submissions must be either delivered in person or received by mail no later than 4:00 PM EST on January 4, 2017. Please deliver or mail the final RFP in a sealed envelope to the following address:

**City of Pikeville
Attn: Christy Billiter
243 Main Street
Pikeville KY 41501**

Late responses will not be considered.

Please identify any proprietary and/or confidential information as such.

Summary of RFP Process Deadlines

The following is the schedule for responding to this RFP. The schedule is subject to change:

November 23, 2016 – RFP issued

December 2, 2016 – Deadline for submitting letter of intent to respond to RFP

December 9, 2016 – Deadline for submitting questions about this RFP to the City

December 16, 2016 – Responses to questions due (from City)

January 4, 2017 – RFP responses due

The City of Pikeville thanks you in advance for your thoughtful response.

XIII. Personal Presentations

At its discretion, the City may request that vendors and other parties that provide a timely response to this RFP make an individual and personal presentation to better explain information or solutions identified in the response. These presentations, if requested by the City, shall be held at a time and place of mutual convenience.

Appendix A: KMZ Map of Phase One Service Area

Appendix A is attached as a separate KMZ map file.

Appendix B: Partnership Fiber Construction Standards

1. General Requirements of Construction Services

This section defines general requirements and terms applicable to all construction services provided by the Contractor.

1.1. General Work Elements

The following elements apply to all work specified in this document unless a specific exception is noted in the specifications for the individual item.

- Each item shall be installed in accordance with the design at locations as shown on the plans or as directed by the City.
- Backfill in trenches, around forms and vaults, or at any other place shall be completed thoroughly using a power tamper in lifts of not more than six inches as it is being placed unless otherwise directed in writing by the City. Any paving material or fill removed for trenching shall be replaced in kind per City ordinance.
- All holes and trenches shall be protected at the Contractor's expense from accidental entry by vehicles and pedestrians through use of steel plates or other approved materials as required by the City or Kentucky Transportation Cabinet Standard Specifications. Should the Contractor fail to provide adequate protection to the surroundings of a work site, or should the operations be carried out in such a way as to allow or cause damage to any roadway, street, sidewalk, the property of any utility, or other private or public property, work may be stopped until deficiencies are corrected. Should the repair not be undertaken and should it be necessary for the City to protect the area and/or make the repair, the cost shall be deducted from payment due the Contractor.
- At the discretion of the City, sod shall be removed either by use of an approved sod cutter and then replaced, or topsoil and seed shall be placed. Care shall be taken to minimize the disturbance, and the area shall be fully restored.
- All concrete work shall be performed and tested in accordance with applicable Kentucky Transportation Cabinet Standard Specifications. Concrete shall be finished to match any adjacent concrete. If no match is required, the surface area shall be broom finished and edged.

- All fiber cable shall be transported by and unreeled from a cable trailer(s). The laying of reels on the ground and subsequent removal of fiber cable from this position is prohibited.

1.2. Work Standards and Quality

1.2.1. Applicable Standards

The Contractor shall comply with the National Electrical Code, the National Electric Safety Code, and Bellcore standards, as well as any and all other applicable Federal, State and local laws and regulations. Contractor is retained by the City for this Project based on Contractor's expertise and experience in the type of work that is the subject of this Contract. Contractor represents and warrants that Contractor is familiar with the aforementioned Codes and standards as well as those referenced below. Construction methods and techniques used by the Contractor shall be in accordance with the recommended practices and procedures published by leading industry manufacturers and trade associations, including but not limited to the following:

- Bellcore Blue Book of Construction Practices;
- Society of Cable Telecommunications Engineers (SCTE) Recommended Practices for Optical Fiber Construction and Testing;
- Kentucky Occupational Safety and Health (OSH) Program; and
- Federal Occupational Safety and Health Administration (OSHA) regulations.

The Contractors shall also follow all other applicable standards, including the Kentucky Transportation Cabinet Standard Specifications. The Contractors shall be aware of all standards and their application. Ignorance or lack of knowledge shall not be an excuse for improper work to occur. Any work constructed in violation of any applicable code shall be corrected and re-installed properly at the Contractor's expense.

1.2.2. Unsatisfactory Operations

Should it be necessary to halt the work because of incorrect or unsatisfactory operations under the terms of the awarded contract or because of failure to follow safety standards applicable hereto, the Contractors must take immediate steps to remedy the deficiencies. Should repair or correction of any safety defect or deficiency not be immediately undertaken, and should the City be required to protect the site or make the repair or correction, the cost of such work shall be deducted from payment due the Contractor.

1.2.3. Inspection and Testing

The Contractor shall be responsible for performing quality control inspection and testing as required to verify that workmanship and products are provided as specified in this document, to include fiber optic cable performance testing, inspection of roadway and right-of-way restoration, and material testing of concrete and backfill placement. The Contractor shall be responsible for testing concrete structures and backfill to demonstrate compliance with the Kentucky Transportation Cabinet Standard Specifications.

During any inspection, including, but not limited to, the final inspection of each work site, should it be found that non-concealed work is substandard, the burden of proof that the concealed work is up to standard shall be the Contractor's, who shall do such as is necessary, including exposing the concealed work, to clearly establish that the concealed work meets the specifications as outlined. Any and all items such as, but not limited to, improperly set couplings and concrete or masonry work that is not up to specified standards shall be removed and replaced at the Contractor's expense.

1.3. Underground Cable Construction

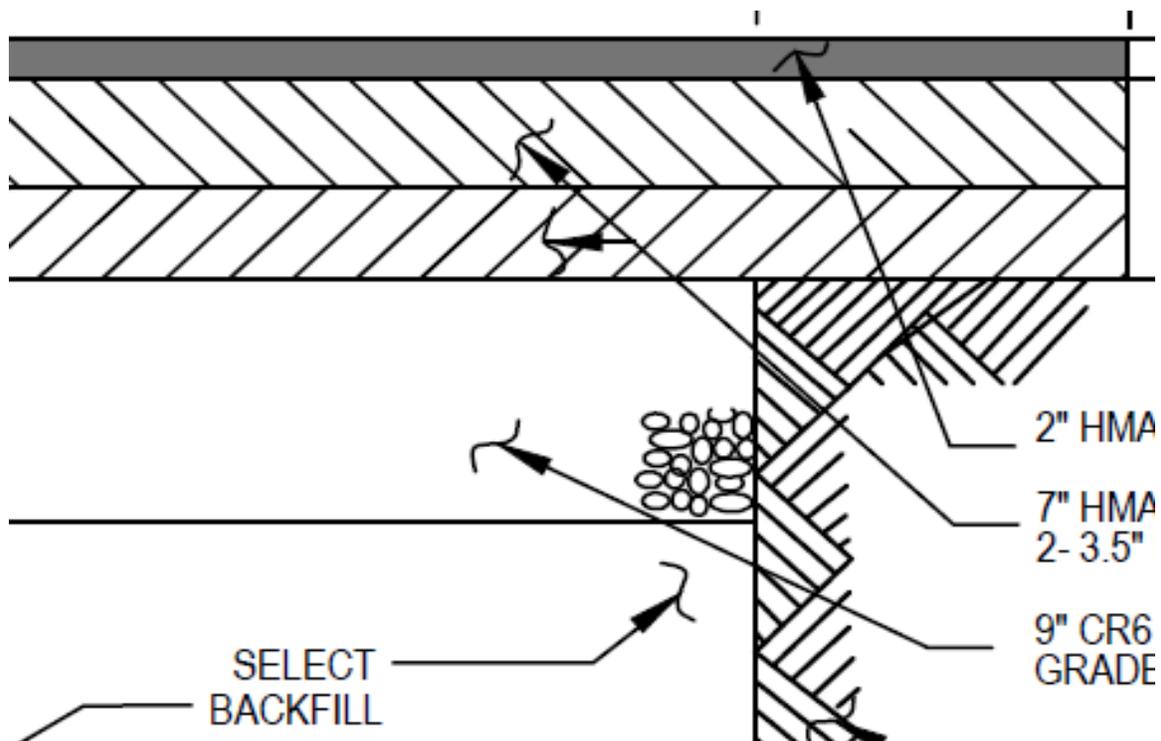
Before construction, the Contractor shall provide notification to underground utility owners using appropriate Kentucky811 underground location and marking services.

Pull-tapes with linear length markers and a minimum tensile strength of 1,100 pounds shall be placed in all installed conduit. Tracer wire for purposes of locating conduit shall be placed within all installed conduit.

The minimum bend radius specified by the cable manufacturer shall be observed by the Contractor at all times when handling the fiber cable. Fiber cable storage loops shall be installed in handholes at locations prescribed by engineering drawings supplied by the City, and cable shall be coiled with a bend radius no less than specified for storage by the cable manufacturer.

The Contractor shall perform permanent surface restoration where required for all disturbed areas, including for test pits within City-maintained roadways and sidewalks according to City standards and/or City Inspector instructions. Test pit restoration within City-maintained roads shall generally consist of a saw cut of pavement, at least one foot in all directions surrounding the perimeter of the disturbance, and a patch of hot mix (Figure 2). Kentucky Transportation Cabinet and Pike County restoration shall be done consistent with their respective permit requirements as applicable.

Figure 2: Typical City Roadway Repair Standards



The Contractor shall be required to perform temporary cold patch repairs of disturbed asphalt immediately.

In the event of accidental damage or otherwise unnecessary surface disturbances caused by the Contractor, the Contractor shall be responsible for all costs related to permanent restoration of all surfaces. The City shall determine, in its sole and absolute discretion, the reasonableness of surface disturbances caused by the Contractor. Field markers or marking poles shall be installed along underground fiber routes after installation.

1.4. Fiber Laterals / City Service Drops and Inside Plant Construction

Fiber Laterals to City facilities shall consist of a 12-count single mode, indoor/outdoor and/or plenum-rated fiber optic cable installed within a 2-inch inch underground conduit unless otherwise noted by engineering drawings supplied by the City.

Underground service drops to City facilities shall be placed in conduit from the nearest handhole per supplied engineering drawings, and shall enter the facility at the existing utility and/or telecommunications demarcation location. Where available, new fiber drop cable shall be placed in existing conduit. A minimum of 100 feet or 15 percent of the drop length, whichever is greater, shall be provided and stored as excess fiber at the termination location or point of facility entrance unless specified otherwise by engineering drawings supplied by the City.

All inside plant construction shall meet applicable federal, state, and local codes, laws and regulations, as well as use approved construction methods and meet aesthetic standards of the building owner. All fiber cables must be properly bonded and grounded upon building entrance, where applicable. All fibers entering and exiting facilities shall be spliced in rack-mounted or wall-mounted splice enclosures and fiber patch panels.

Outdoor-rated cable shall not be run for a distance of more than 50 feet internal to the facility unless installed within Electrical Metallic Tubing (EMT). Building penetrations shall be properly sealed to prevent water seepage. Appropriate fire-stop sealant materials shall be used wherever cables, innerduct, and/or EMT must penetrate fire-rated walls or floor assemblies.

Each termination and patch panel will be labeled to identify the termination point of the fiber according to a naming schema to be approved by the City. Fiber connectors shall be LC/UPC.

1.5. Fiber Testing

The Contractor shall perform optical performance tests during construction to validate that installed cable is not damaged or defective, and that outdoor splices meet performance requirements. This testing will generally occur prior to termination of fiber strands, and will require the use of bare fiber adapters for temporary connectorization. This testing must occur after cable is installed with all intermediate backbone splices and mid-sheath splices completed on any particular segment. This testing shall consist of bi-directional end-to-end OTDR testing for each fiber strand installed.

Additionally, final acceptance shall be contingent upon successful end-to-end testing of each terminated fiber strand will be tested end-to-end to validate the optical performance of the entire link, as well as to verify that fiber splicing has occurred according to supplied splice matrices. This testing will consist of bi-directional OTDR testing, as well as direct optical attenuation and continuity testing using a calibrated optical source and power meter. This testing shall occur only after fibers are terminated on both ends of a link, and all intermediate construction and/or splicing involving the re-entry of installed splice cases or handling of the fiber optic cable is completed for a particular segment under test.

The Contractor shall provide the City with electronic documentation of all test results.

1.5.1. Testing Criteria

Testing shall be deemed successfully completed if: (1) maximum fiber losses meet manufacturer specifications, with an allowance for splices and connectors; (2) individual splice losses do not exceed 0.1 dB; and (3) maximum mated connector losses do not exceed manufacturer specifications. Testing will be performed by Contractor personnel, and may be observed by designated representatives of the City. The City may request and/or perform additional testing to verify results prior to accepting test data.

1.5.2. OTDR Testing Procedure

An OTDR shall be used to measure and document splice losses and connector losses. To correctly identify abnormalities at a short range, a 100-meter or longer launch cable shall be used between the OTDR and the fiber under test. Bi-directional traces shall be acquired for each fiber. If the connection of the launch cable to the patch panel requires optimization by the operator, sampling acquisition will commence upon completion of the optimization.

Each fiber will be identified, and the results of the test for each fiber will be recorded as indicated below. The test will be repeated for each of the fibers linking a particular site. All tests will be made at 1310 nm and 1550 nm.

Settings on the OTDR shall reflect the following:

- A. The Refractive Index shall be set for the actual fiber utilized (commonly-used Corning SMF-28 single mode fiber has a refractive index of 1.4677 at 1310 nm);
- B. Pulse width no greater than 100 ns (10m) for all fiber lengths;
- C. Scattering coefficient specified by the fiber manufacturer for each wavelength tested;
- D. A minimum of 10,000 sampling acquisitions (averages);
- E. Maximum range set to no more than 10 km for all fiber length less than 10 km;
- F. Maximum range set to no more than 25 km for fiber lengths greater than 10 km; and
- G. Event threshold: 0.05 dB.

A uniform file-naming scheme for recorded data shall be used, complying with the following conventions or mutually agreed conventions by the City and Contractor:

xxxx###_yyyy***

*Where:

- xxxx = four-place alpha-numeric site designation, splice location (SP01, SP02, etc.), or fiber tap (T01A, T01B, etc.) at which the OTDR is located
- ### = three digit fiber port number (or fiber strand number for un-terminated fiber)
- yyyy = four-place alpha-numeric site designation, splice location (SP01, SP02, etc.), or fiber tap (T01A, TP01B, etc.) at the opposite end from where the OTDR is located
- *** = three digit fiber port number (or fiber strand number for un-terminated fiber)

For example, HUBB027_T02B001.trc would be the OTDR trace captured from port 27 at the Hub for Service Area B to port 1 on Tap 2B. The filename T02B001_HUBB027.trc would be for the OTDR trace captured on this same fiber in the opposite direction.

Installed optical fiber OTDR test documentation shall include:

- A. Total fiber length;
- B. Individual fiber traces for complete fiber length;
- C. Losses of individual splices and connectors;
- D. Losses of other anomalies;
- E. Wavelength tested and measurement directions;
- F. Manufacturer, model and serial number of the test equipment; and
- G. Name and company of the technician performing the tests.

All data collected at each location during the tests shall be recorded at the time of the tests using electronic means.

1.5.3. Optical Power Meter Test Procedure

Optical power meter measurements shall be made at the same time as the OTDR tests to determine overall fiber loss and to ensure that fibers have appropriate end-to-end continuity (fibers not crossed). Power meter testing shall be performed at both 1310 nm and 1550 nm and shall report the relative loss of each fiber strand.

1.6. Engineering Redlines

The Contractor shall perform field markups of reflecting specific as-built construction parameters following construction. All such documentation shall be provided to the City and any designated engineering personnel.

Redlines shall identify the lateral placement of conduit relative to its distance from the curb or other defined landmark (roadway centerline, sidewalk, etc.) at intervals not to exceed 50 feet, and shall provide precise latitudinal and longitudinal coordinates of the center of each handhole. Redlined prints shall identify any deviations from engineering drawings, including actual cable slack distances placed (whether more or less than specified).

The Contractor shall supply the City with log data from the directional bore guidance system used during construction, indicating depth of the conduit placement. Also, redlines shall indicate measured depth of conduit placement for conduit placed using open trenching or open cut methodologies.

Construction may not deviate from engineering drawings without prior approval from the City or its appointed designee.

1.7. Material Handling

1.7.1. Materials Transport

The Contractor shall be responsible for trans-shipping any material provided by the City between their yards and for maintaining the inventory of these items once acquired from the City or

received from suppliers on behalf of the City. Materials or equipment shall be transported in a legal fashion and shall be protected from damage or loss. Lost or unaccounted material will be the responsibility of the Contractor, and will be reimbursed to the City.

1.7.2. Materials Damaged

Any damage to or loss of any materials or equipment supplied by the City to the Contractors, which occurs from handling or transport, or from any other source or way, shall be the sole responsibility of the Contractor and the value thereof shall be deducted from any payments due the Contractor.

1.7.3. Salvageable Materials

The Contractor shall salvage all useful materials provided by the City and reuse materials for other City projects to the extent feasible at the Contractor's discretion.

1.7.4. Materials Returned to the City

The Contractor shall return to the City any City-supplied materials and fiber optic cable greater than 300 feet.

1.8. Safety Documentation and Training

The Contractor shall comply with all the requirements set forth in Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330) as supplemented by Department of Labor regulations (29 CFR Part 5). The Contractor shall maintain records of safety training classes held, and any safety certifications held by its employees and sub-contractors.

The Contractor, its employees, agents, and subcontractors must be trained on the Underground Damage Prevention statutes and best practices prior to excavating on the City project. All Contractor crew members must carry a training verification card with the date of training and prime contractor/subcontractor crew name at all times.

1.9. Construction Safety and Health Standards

The Contractor and any subcontractors shall not require any laborer or mechanic employed in performance of the contract to work under working conditions or in surroundings which are unsanitary, hazardous, or dangerous to the worker's health or safety, as determined under construction safety and health standards (Title 29, Code of Federal Regulations, Part 1926, published in the Federal Register on December 16, 1972), as revised from time to time. The Contractors and any subcontractors shall comply with any and all KOSH and OSHA regulations.

1.10. Traffic Control and Work Area Protections

The Contractor shall provide all equipment necessary to protect the well-being of employees, motorists and all others who come in contact with construction areas. Such precautions include, but are not limited to, crash cushions, flashing arrow boards, lighted barricades, steel plates, and

concrete barriers. The Contractor shall ensure that all required signage meets Federal, State and Local standards.

The Contractor shall furnish, erect, maintain, relocate, and/or remove traffic control devices in accordance with the Contract Documents, as well as the latest versions of the Kentucky Transportation Cabinet Standard Specifications, or as directed by the City.

All traffic control devices furnished by the Contractor shall remain the property of the Contractor, unless otherwise specified by the contract. Traffic control devices shall include, but are not limited to signs, drums, barricades, barriers, electronic variable message boards, cones, delineators, flashing arrow panels, temporary guardrails, temporary concrete median barriers, vehicle-mounted temporary impact attenuators, pavement markings, raised reflective pavement markers, Kentucky Transportation Cabinet Certified flaggers, and pilot vehicles.

1.10.1. Traffic Control Construction Methods

Existing public streets or highways shall be kept open to traffic at all times by the Contractor unless permission to close these streets, or portions thereof, is granted by the City. In addition, the City must be contacted BY THE CONTRACTOR A MINIMUM OF 24 HOURS before any streets are closed or partially closed. The City may request that the Contractor make additional notifications to property owners.

Traffic control devices shall be installed at the inception of construction operations, and shall be properly maintained, relocated as necessary, cleaned, and operated during the time they are in use. They shall remain in place only as long as they are needed and shall be immediately removed thereafter. Where operations are performed in stages, only those devices that apply to the conditions present shall be left in place.

During periods when not warranted, warning signs and other devices shall be removed from the work area, covered with specified material, or otherwise positioned so that they do not convey their message to the traveling public. Covering material shall be maintained in a neat manner during its use.

Weeds, brush, trees, construction materials, equipment, etc. shall not be allowed to obscure any traffic control device in use. There will be no separate compensation for any trimming or cutting required for this purpose.

Competent and properly trained flaggers, properly attired and equipped, shall be provided in accordance with Kentucky Transportation Cabinet standards and when directed by the Engineer or Inspector or when the Contractor deems it necessary to safely handle traffic through the construction zone.

The Contractor shall assume full responsibility for the continuous and expeditious maintenance of all construction warning signs, barricades, and other traffic control devices which in the opinion of the Engineer are damaged by traffic or other means or deteriorated beyond effectiveness. Conditions covered under maintenance shall include but not be limited to replacement due to loss of reflectivity; replacement of broken supports; plumbing of leaning signs; cleaning of dirty signs, barricades, and other devices; repair of defaced sheeting and legend; and replacement of stolen or vandalized items. All items used for traffic control shall be maintained in a satisfactory condition. Failure to maintain all traffic control devices in a satisfactory condition may be cause for suspension of construction operations until proper traffic control is re-established.

The Contractor shall follow the construction procedure and maintenance of traffic as shown on the Traffic Control Plan, unless a more workable plan is agreed to by the City prior to or during the execution of the work. The Contractor shall complete each construction phase in the sequence shown if phasing is specified.

The Contractor shall continuously review and maintain all traffic control measures to assure that adequate provisions have been made for the safety of the public and workers.

1.11. Accident Reporting

Any accident resulting in damage to property or causing personal injury within the limits of a work site shall be immediately reported to the appropriate police agency, other required agencies and the City.

The Contractor shall immediately contact the Utility Operator/Owner and the City when damage to an underground facility is identified. If a Natural or Propane Gas line is damaged, the Contractor must call 911 prior to notifying the Utility Operator. The Contractor shall not backfill around the underground utility line until the Utility Operator has repaired the damage and has given clearance to backfill. The City will not pay the Contractor for labor, vehicles, material, or equipment or any other cost associated with the repair to any at-fault damage. Failure to comply may result in a verbal warning, suspension of the crew, loss of work, and/or termination.

2. Fiber Construction and Maintenance Specifications

The following sections define the technical requirements and specifications for Turnkey fiber construction and maintenance services and materials to be provided on a per unit basis. All work performed shall adhere to all applicable requirements of this Section, and shall include all necessary materials for completing the construction tasks according to the task and material specifications provided.

Bids shall be for turnkey delivery of a functional fiber optic network as specified in this document. Bid pricing shall remain valid during the term of the negotiated contract for same services required for the expansion or modification of the particular project scope or design. Proposed pricing for each unit shall reflect the entirety of fees due to the Contractor for the scope of work defined by this document, inclusive of materials, shipping, direct labor expenses, benefits, profit, overhead, and any indirect costs. Pricing shall include all basic mobilization, site preparation, work area protection, site restoration, and standard traffic control necessary to perform the task safely and according to all applicable specifications in this document.

Unless otherwise specified, the basis of pricing and payment for lineal foot-based units shall be network route distance, not material length (conduit, innerduct, etc.). The City shall not be invoiced for costs associated with scrap or waste materials. Prices are to include all shipping costs. Bidders are to review the Project specifications carefully to determine if any miscellaneous materials not specified in this Section will be necessary to perform the defined project scope, and to include all necessary materials in the bid.

The selected contractor is to store and issue all material except as otherwise directed by the City. The materials specified, or an approved equivalent, shall be supplied by the Contractor and used as needed to complete the scope defined in this document. All materials supplied shall be new and unused and, where applicable, all materials and equipment supplied shall be UL-approved.

The "Project Total Bid" shall be the basis of bid pricing evaluation, and must represent a turnkey price for fiber maintenance and construction of the Pikeville Fiber Optic Communications Network as described within this document. Unit pricing for items indicating a quantity of zero (0) are included to solicit pricing for alternative construction methodologies and/or material options that may offer functional or cost savings benefits depending on particular field conditions and/or design revisions. Pricing for these items will be considered in evaluating the completeness of the response and overall value provided.

2.1. Fixed Emergency Response Retainer Fee

Item #0: Emergency Response Retainer Fee

This item includes a monthly fixed fee to provide the following services;

- Guaranteed onsite fiber emergency repair response for the entire City's fiber plant and hub facilities
- Ongoing preventative maintenance of the City's hub facilities and network equipment
- Acting as the receiving station for incoming utility locates and registering map grids with Miss Utility as applicable
- Maintaining the City's as-built documentation in PDF and ESRI-based GIS formats

Pricing shall include the onsite arrival of all necessary equipment and personnel resources within required timeframes after a service request is initiated. The network footprint will entail

deploying 57.0 miles distribution fiber to pass 2,850 locations and deploying hub facilities over the course of this contract. Pricing shall be tiered to represent the increase of the fiber maintenance scope over the course of the contract.

Retainer Fees shall include guaranteed telephone access to Contractor personnel for notification purposes during operating hours suitable to meet the response timeframe requirements.

Retainer fees shall be inclusive of routine maintenance of hub locations. This shall involve inspections and preventive maintenance of cabinets, HVAC units, Alarm systems, and Fire suppression systems at each applicable location. Inspections and maintenance shall be scheduled and completed on time intervals that meet or exceed the respective manufacture's specification. Inspection reports shall be created and distributed to the City no later than 3 business days after an inspection has taken place.

Retainer fees shall be inclusive of all coordination with Kentucky811 on the City's behalf. This shall involve acting as the receiving station for incoming locate requests and registering new grids with Kentucky811.

Retainer Fees shall be inclusive of updating and maintaining the City's fiber database with any changes made to the FTTP network by the Contractor, the City, or the City's Agents. The contractor shall access the fiber database as directed by the City.

The Contractor shall update the database with all information captured in standard as-built documentation including but not limited to:

- The depth and offset of conduit placement in reference to the edge of pavement or other locatable features when the edge of pavement is not applicable
- The quantity and sizing of each fiber cable/tap terminal tail within the conduit
- GPS coordinates of handhole/pole locations
- Total slack footage located at each handhole location or aerial snowshoe/fiber coil
- The quantity and sizing of each fiber cable/tap terminal tail within the conduit or aerial attachment
- The location of fiber taps or splice enclosures
- Splicing details of each enclosure
- Fiber termination location at each hub/served site

Retainer Fees shall not be inclusive of applicable unit based fees required to perform the necessary fiber plant repairs.

2.2. Underground Conduit and Cable Installation

Item #1: Installation of Ground Rod

This item includes the supply and installation of a grounding rod, as well as a length of copper wire to bond to the item to be grounded. A minimum of 8 feet of the ground rods must be driven into undisturbed soil. The contractor shall supply up to 30 feet of copper grounding wire and shall cut the wire to the length as necessary. The grounding wire shall be properly bonded to the grounding rod.

Supplied materials shall consist of the following components:

- Ground Rod, Sectional, 13 mil copper-clad steel, 5/8-inch diameter, 8-foot length, Erico 635883 or approved equivalent.
- Driving Stud, 5/8", high strength carbon steel, must withstands hammer impact while driving sectional rods (same manufacturer as rod)
- Ground Rod Clamp, 5/8", high strength bronze alloy, corrosion resistant, accommodates #12 to 1/0 AWG, suitable for direct burial. Electric Motion EM 2DB-01 or approved equivalent.
- #6 copper ground wire, green insulation, typically 6-foot length.

Item #2: Installation of Conduit

This item consists of the supply and installation of rolled duct (conduit), having a nominal diameter ranging from 1.25-inches to 4-inches, with all necessary fittings. The City has the right, in its sole and absolute discretion, to reject any installation method proposed for a given work site.

Note that installation of conduit, regardless of methodology, shall comply with all applicable specifications in this document. Surface restoration, test pitting, work area protection, and related work not otherwise explicitly included in other construction Bid Items shall be incidental to this Item, and must be included in the unit pricing for this Bid Item.

The Contractor shall provide high-density polyethylene (HDPE) roll duct meeting applicable ASTM standards. All supplied conduit shall have a smooth inner wall and smooth outer wall. All conduit shall be pre-lubricated, and contain a pre-installed 1100 pound polyester pull tape.

Unless otherwise specified by City-supplied engineering drawings, conduit shall have a minimum cover of 36 inches as measured from the finished grade, and a minimum of 48 inches below the elevation of the adjacent edge of pavement, whichever is deeper. Conduit not terminated to a base or in a vault shall be terminated two feet beyond the edge of the finished grade otherwise directed by the City. Conduit shall not extend more than three inches inside a vault or junction well.

Splicing or joining of HDPE conduit is prohibited without prior approval from the City. All conduit joints shall be sealed with the appropriate cement to ensure that the two conduit pieces bond to one another to form a solid waterproof link. For metallic conduit, install metallic bushings and bond conduits.

If not already pre-installed by the manufacturer, a polyester or polypropylene pulling rope or tape with a minimum rated strength of 1,100 pounds shall be installed in each conduit for future use.

A tracer wire for locating purposes shall be installed in at least one conduit in each segment or conduit bank as part of this item immediately upon placement of the conduit. The tracer wire shall be 10 AWG copper wire, UL-listed, with green insulation. The tracer wire shall be pulled simultaneously with the installation of fiber optic cable in a continuous length. Where multiple pulls of fiber-optic cable are required and conduit is placed in the same trench or bore, only one tracer wire is required. Where multiple pulls of fiber-optic cable are required and conduits may separate into individual trenches or bores, install a tracer wire in each conduit run. Provide waterproof butt splices where tracer wire is spliced. Splicing is allowed only in handholes, and must be bonded to the electrical ground rod in each handhole.

For all conduits entering handhole boxes, seal spare conduits with approved duct plugs. Seal conduits containing fiber-optic communications cable with mechanical sealing devices.

All underground conduit paths shall be marked using visible, above-ground markers to prevent unintentional damage. Markers shall be placed so that the next closest marker is clearly visible in either direction, or approximately every 75 feet, whichever is less. Soil Disk markers shall be used to mark conduit paths in of frequently grass cutting and maintenance. Soil Disk markers shall be orange disks, 6 to 8-inch diameter, with 13-inch stainless steel stakes. Domed Post Markers shall be used along road-sides wherever they can be placed without causing a safety or maintenance obstruction. Domed Post Markers shall be white, 6-foot height, 3.5-inch diameter, and include an orange dome cap and anchor bar for ground attachment. Soil Disk Markers and Dome Post Marker caps shall be labeled with the following text in in UV stabilized black lettering:

“WARNING – BURIED FIBER OPTIC CABLE”
“Call 811 Before Digging”
“City of Pikeville”

On or inside a building, conduit shall be installed by drilling anchors into concrete, brick, stone, steel, or wood and mounting the conduit with the proper clamps or hangers.

If bends are required during installation, they must be sweeping bends. All bends shall have a minimum radius of no less than ten times the outer diameter of the conduit, or 20-inches,

whichever is greater. No individual conduit segment between two handholes shall have more than 180-degrees of total bends. The City shall be consulted before any bends are installed to ensure that the proper arc is provided.

Conduit placement shall consist of the following varieties:

- 1.25-inch (1¼") HDPE
 - SDR 11
 - 1.660-inch nominal outer diameter
 - 1.358-inch nominal inner diameter
 - 0.151-inch minimum wall thickness
 - Carlon #A6C6D1JNNB or approved equivalent

- Two-inch (2") HDPE
 - SDR 11
 - 2.375-inch nominal outer diameter
 - 1.943-inch nominal inner diameter
 - 0.216-inch minimum wall thickness
 - Carlon #A13C6D1JNNB or approved equivalent

- Four-inch (4"), HDPE
 - SDR 11
 - 4.500-inch nominal outer diameter
 - 3.682-inch nominal inner diameter
 - 0.409-inch minimum wall thickness
 - Carlon #A16C6D1JNNB or approved equivalent.

Item #2a: Installation using Directional Boring

This item consists of horizontal directional drilling/boring and placing conduit. Directional boring is the required underground placement technique unless approved otherwise by the City. The size of a bore shall not exceed the outside diameter of the conduit by more than one (1) inch. If it does, cement grout shall be pumped into the void.

At all points where HDPE conduit will traverse under roadways, driveways, sidewalks, or Controlled Access Areas including entrance/exit ramps, conduit shall be placed a minimum depth of 4 feet or 8 times the back reamer's diameter, whichever is deeper. Conduit shall be placed to maintain a clearance of one foot (12-inches) from drainage pipe less than 60-inches in diameter while maintaining all other required clearances. A depth of 15-feet below finished grade may be

required when crossing a Kentucky Transportation Cabinet -maintained controlled access highway, or as specified by approved permit drawings.

The Contractor shall guarantee the drill rig operator and digital walkover locating system operator are factory-trained to operate the make and model of equipment provided and have a minimum of one year experience operating the make and model of drill rig. The Contractor shall submit documentation of the operators' training and experience for review at least two weeks before start of directional drilling operations.

The Contractor shall provide a means of collecting and containing drilling fluid/slurry that returns to the surface such as a slurry pit, and shall provide measures to prevent drilling fluids from entering drainage ditches and storm sewer systems. The Contractor shall prevent drilling fluid/slurry from accumulating on or flowing onto pedestrian walkways, driveways, and streets. Immediately remove all drilling fluids/slurry that are accidentally spilled. The Contractor shall transport waste drilling fluid/slurry from site and dispose of in a method that complies with local, state and federal laws and regulations.

The Contractor shall perform electrical grounding of the drill rig when in use in accordance with the manufacturer's recommendations.

All excavated material shall be placed near the top of the working pit and disposed of properly. The Contractor shall backfill pits and trenches to facilitate drilling operations immediately after drilling is completed.

During drilling operation, the Contractor shall locate the drill head every 10 feet along drill path and before traversing underground utilities or structures using a digital walkover locating system. The locating system must be able to determine pitch, roll, heading, depth, and horizontal position of the drill head at any point.

Upon completion of the conduit installation, the Contractor shall perform a mandrel test on the conduit system to ensure conduit has not been damaged using a non-metallic mandrel with a diameter or approximately 50% of the inside diameter of the conduit. If damage has occurred, replace the entire length of conduit and ensure that pull line is re-installed.

Item #2b: Installation Under Existing Pavement - Open Cut

This item consists of trenching/cutting in existing pavement and placing conduit in an open trench. All open cutting of roadways must first be approved by the City or applicable permitting authority. The conduit shall be installed by cutting a slot in the pavement with a masonry saw. The contractor shall be responsible for the removal of all cut pavement and the replacement and correction of any damaged pavement once the conduit(s) are installed.

The Contractor shall install HDPE conduit for all underground runs, unless otherwise specified by engineering drawings for special conditions (i.e. where conduits cross beneath railroad tracks). If more than one conduit is required between the same points, install conduit in one common trench. The Contractor shall install non-detectable warning tape in each trench directly above the conduit run at a depth of approximately 12 inches below existing grade. Warning tape shall be bright (Day-Glow) orange and 3-inch (or 75 mm) wide to allow for easy visual detection with wording "WARNING – OPTICAL CABLE" or similar message approved in advance, repeated on tape at least every 3 feet or 1 meter.

The Contractor shall remove all rock and debris from backfill material, and shall remove excess material from site and compact area. The Contractor shall backfill with excavated material and compact to 95% of original density per AASHTO T-180. The purpose of the backfill is to provide a gradual change in elevation of the trench, so that excessive bending and stress will not be transferred to conduits once underground conduit system is installed.

After installation of conduits and upon completion of tamping and backfilling, perform a mandrel test on each conduit to ensure no conduit has been damaged. Upon completion of the conduit installation and backfill, the Contractor shall perform a mandrel test on the conduit system to ensure conduit has not been damaged using a non-metallic mandrel with a diameter or approximately 50% of the inside diameter of the conduit. If damage has occurred, Contractor shall replace the entire length of conduit at no cost to City. Contractor shall ensure pull line is re-installed.

The Contractor shall be responsible for performing temporary patching of affected pavement immediately upon installation of conduit.

Item #2c: Installation in Unpaved Right-of-Way - Open Trench

This item consists of trenching/cutting in unpaved right-of-way and placing conduit in an open trench. When trenching is used, the opening shall be filled half way with the cover material, and tamped down firmly before filling in the remainder of the opening to 12 inches below grade.

A fiber optic warning tape shall be installed and the remainder of the fill shall be added, tamping down the top layer. The Contractor shall install non-detectable warning tape in each trench directly above the conduit run at a depth of approximately 12 inches below existing grade. Warning tape shall be bright (Day-Glow) orange and 3-inch (or 75 mm) wide to allow for easy visual detection with wording "WARNING – OPTICAL CABLE" or similar message approved in advance, repeated on tape at least every 3 feet or 1 meter.

The Contractor shall rake smooth the top 1 ½ inches, and seed with same type of grass as surrounding area. Finish unpaved areas flush with surrounding natural ground.

Item #3: Installation of Additional Conduit

This item consists of the supply and installation of one or more additional conduits in conjunction with the installation of a single conduit (Item 2). Additional conduits may be stacked one on top of the other, side by side, or in a matrix. The orientation shall be at the contractor's discretion, but conduits shall not twist around one another or be allowed to deviate from straight-line paths, except in the case of bend installations. Conduits installed at the same time in the same trench or slot shall remain oriented the same in relation to one another throughout the conduit run.

Additional conduits installed using directional boring shall be limited to a total of three 1.25-inch or two 2-inch conduits. Proposed pricing shall consist only of incremental costs associated with the additional conduit(s) beyond that of Item 2.

Item #4: Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE

This item consists of the supply and installation of one or more innerduct in an existing or newly installed empty conduit or other existing outdoor cable pathway.

The Contractor shall rod existing conduit to ensure that it is free of any obstructions before installing a pull rope or innerduct. If a pull rope is not already pre-installed in the innerduct, the Contractor shall place a pull rope or mule tape in each innerduct.

Supplied innerduct shall be high-density polyethylene (HDPE) innerduct. All innerduct shall contain a pre-installed 1100-pound polyester pull tape, and shall have the following characteristics:

- Corrugated construction, orange
- 1.25-inch nominal inner diameter
- 0.035-inch minimum wall thickness
- Plenum rated and UL listed to UL910
- Tensile pulling strength: 319 pounds
- Color: orange
- Carlon A6D2S1JNNBxxxx, or approved equivalent.

Item #5: Installation of Microduct and Microfiber

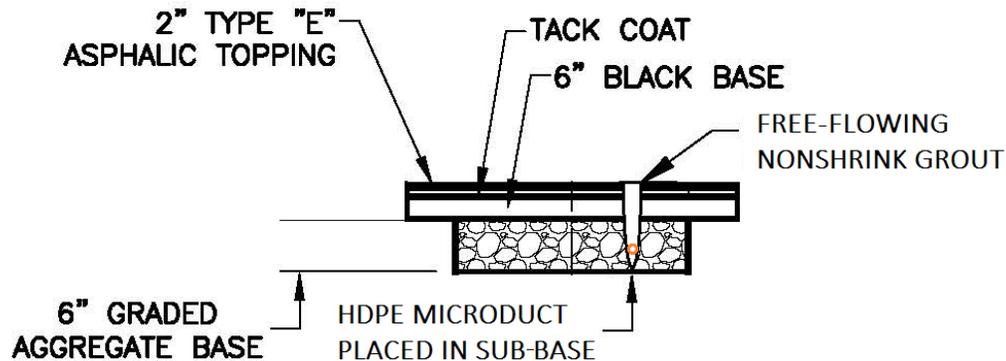
These items consist of installing microduct(s) having a nominal outer diameter ranging from 10 millimeters to 14 millimeters (Material Bid Item #B3), with all necessary fittings, and the installation of microfiber cable designed for air-blown fiber installation (Material Bid Item #B15). The City has the right to reject any installation method proposed for a given work site.

Note that installation of microduct, regardless of methodology, shall comply with all applicable specifications in this document. Surface restoration, mobilization, work area protection, and related work not otherwise explicitly included in other construction Bid Items shall be incidental to this Item, and must be included in the unit pricing for this Bid Item.

The Contractor shall provide high-density polyethylene (HDPE) duct meeting applicable ASTM standards. All supplied microduct shall have a smooth inner wall and smooth outer wall.

Microduct shall be placed at the depth specified by engineering drawings, unless otherwise specified by City-appointed inspector. Where installed beneath paved roadways, microduct shall be placed in the sub-base below the roadway base layer (generally 8 to 14 inches below the paved surface). Microduct not terminated to a base or in a vault shall be terminated two feet beyond the edge of the finished grade otherwise directed by the City.

Figure 3: Typical Micro-Trench Detail



Splicing or coupling of HDPE microduct is prohibited without prior approval from the City. All microducts shall be sealed in handholes and other termination locations per manufacturer specifications.

Microducts shall be installed per manufacturer recommendations and specifications, including minimum bend radius and pulling tensions.

Item #5a: Installation Under Existing Pavement – Micro-Trenching

This item consists of cutting into existing pavement to create a trench with a maximum width of 1.5-inches and maximum depth of 14-inches, and placing microduct in an open trench. All open cutting of roadways must first be approved by the City. The conduit shall be installed by cutting a slot in the pavement with a masonry saw. The contractor shall be responsible for the removal of all cut pavement and the replacement and correction of any damaged pavement once the microduct(s) are installed.

The Contractor shall install HDPE microduct for all micro-trench runs, unless otherwise specified by engineering drawings. If more than one microduct is required between the same points, install microduct in one common micro-trench. The Contractor shall install tracer wire in each trench directly above the microduct, unless microduct solution has a pre-installed tracer wire.

The Contractor shall remove all excavated material from the job site dispose of properly. Contractor shall place the microduct flat against the base of the trench and anchor with self-compacting pea gravel at intervals of no more than 9-feet. Pea Gravel shall be placed in mounds no more than 3-inches tall. The Contractor shall fill the trench with free-flowing nonshrink grout meeting or exceeding ASTM C 1107 standards. Unless otherwise specified by the City, the trench shall be filled to match the existing finished grade.

Item #5b: Installation in Unpaved Right-of-Way – Micro-Trenching

This item consists of cutting into unpaved right-of-way to create a trench with a maximum width of 1.5-inches and maximum depth of 14-inches and placing microduct in an open trench.

The Contractor shall install HDPE microduct for all underground runs, unless otherwise specified by engineering drawings. If more than one microduct is required between the same points, install microduct in one common micro-trench. The Contractor shall install tracer wire in each trench directly above the microduct, unless the microduct solution has a pre-installed tracer wire.

Contractor shall place microduct flat against the base of the trench and anchor with self-compacting pea gravel at intervals no of more than 9-feet. Pea gravel shall be placed in mounds no more than 3-inches tall. For micro-trenches in unpaved right of way, the trench opening shall be filled to 3-inches below the finished grade with free-flowing nonshrink grout meeting or exceeding ASTM C 1107 standards. The remaining 3-inches shall be filled with matching cover material and seeded with grass of the same type matching the surrounding area. Finish unpaved areas flush with surrounding natural ground.

Item #5c: Installation of Micro-Fiber in Microduct

This item consists of installing micro-fiber in microduct using air-assisted installation. Contractor may use either the “Jetting” or “Blowing” method of air-assisted installation depending on what is recommended by the cable manufacturer’s specification. Contractor shall use an air compressor with a PSIG and CFM output equal to or below the optimal output recommended by the cable manufacturer’s specification. The compressor should have a shut off or clutch feature that limits the push force on the cable. At no time during the installation process shall the cable’s maximum short-term tensile strength be exceeded. The contractor shall use lubricant if required by the microduct manufacturer.

Item #6: Direct Bury Microduct

The Contractor shall provide microduct designed for direct bury, microtrench applications. The Microduct shall be constructed of HDPE that conforms to ASTM D3350-98a, Type III, Category 5, Class B or C and Grade P-34 per ASTM D1248-84 or equivalent. The City requests that proposals include detailed test data and specifications supporting the use of proposed products in direct bury applications. Microduct shall be provided in the following varieties:

Item #6a: HDPE Microduct, 12/8 mm

- 8 mm nominal inner diameter
- 12 mm nominal outer diameter

Item #6b: HDPE Microduct, 14/10 mm

- 10 mm nominal inner diameter
- 14 mm nominal outer diameter

Item #7: Microduct Fiber Cables

The Contractor shall provide microduct fiber optic cable in accordance to the following specifications:

- Micro-fiber cable designed for air-blown microduct applications, containing 12-strand buffer tubes, in 48 and 96-count sheaths, conforming to international standards ITU-T G.652.D and applicable requirements of ANSI S-87-640 and TIA/EIA-455.
- Delivered on reels holding a contiguous fiber cable length of up to 16,000 feet. Pricing shall include return shipping of steel reels if used. The Contractor shall be expected to coordinate cable orders to ensure cable lengths are provided as needed support contiguous cable runs without splicing (not including mid-sheath splices) according to final designs.
- Comprised of All Dielectric (AD) materials.
- Comprised of a gel-free cable design incorporating dry water-blocking elements.
- Marked, in permanent white characters, with:
 - Manufacturer name
 - Month and year of manufacture
 - Number of optical fibers
 - Sequential length markings, minimum of every two feet, in feet

The Contractor shall supply the following fiber cable varieties meeting the above specifications:

Item #7a: 48-strand Micro-fiber Cable, Loose Buffer Tube, Outdoor Cable

Item #7b: 96-strand Micro-fiber Cable, Loose Buffer Tube, Outdoor Cable

Item #8: Installation of Handholes

This item consists of providing and installing conduit handholes. The Contractor shall supply communications handhole boxes (“handholes”) meeting dimensional and structural loading requirements specified by engineering drawings and all applicable permit requirements. Handholes will have a minimum 36” depth below surface that may be obtained by stacking handholes. All handhole lids must be appropriate for the required loading.

All handholes shall have the appropriate ANSI 77-2010 Tier designation/load rating and/or AASHTO Load Rating embedded in a surface that will be visible after installation. All handholes shall be straight-walled with an open bottom. Vaults and iron vault lids meeting AASHTO HS-20 are required for placement within travel lanes of roadways. ANSI/SCTE Tier 15 or Tier 22 handholes may be placed outside of travel lanes in the adjacent right-of-way.

Handholes shall each be provided with a lid, lid bolts, and any required reducing coupler to support 2-inch and 1.25-inch nominal diameter conduit. Supplied lids shall be engraved with the words “**Pikeville Fiber Optics**”.

The base of the handhole shall have gravel to a depth of one inch, or as specified by the City, to promote drainage of water. All conduit ends shall be sealed to minimize water ingress.

The Contractor shall supply and install the following handhole varieties meeting the specified loading standard and having the specified nominal outer dimensions:

Item #8a: Installation of Type 1 Handhole – HS-20, 24” x 36” x 36”

- AASHTO HS-20 Rated
- Composite Construction, UL listed to ANSI 77-2010
- 11” x 18” x 18” dimensions: 24” x 36” x 36” (WxLxD)
- RUS listed
- Straight-walled, open bottom
- Concast FHR-24-36-36, or approved equivalent

Item #8b: Installation of Type 2 Handhole – Tier 22, 24” x 36” x 36”

- Tier 22 Rated (22,500 pound design load, 33,750 pound test load)
- Composite Construction, UL listed to ANSI 77-2010
- Nominal dimensions: 24” x 36” x 36” (WxLxD)
- RUS listed
- Straight-walled, open bottom

Item #8c: Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"

- Tier 22 Rated (22,500 pound design load, 33,750 pound test load)
- Composite Construction, UL listed to ANSI 77-2010
- Nominal dimensions: 11" x 18" x 18" (WxLxD)
- RUS listed
- Straight-walled, open bottom

Item #8d: Installation of Type 4 Handhole – Tier 22, 16" x 22" x 18"

- Tier 22 Rated (22,500 pound design load, 33,750 pound test load)
- Composite Construction, UL listed to ANSI 77-2010
- Nominal dimensions: 16" x 22" x 18" (WxLxD)
- RUS listed
- Straight-walled, open bottom

Item #9: Fiber Optic Cable Placement in Conduit

This item consists of the supply and installation of fiber optic cable in existing or newly installed conduits that may or may not contain an existing communications cable or cable(s). A strain limiter/release element that will part if the strain exceeds 300 pounds for 12-count fiber and 600 pounds for larger cables shall be used for outdoor fiber optic cable between the pulling grip and the pulling medium.

Any and all cable(s) pulled into any conduit without the use of an acceptable pulling grip, kellems or equivalent, or without the use of a strain limiter/release element, or by using methods which may result in pulling forces in excess of strain release material set forth herein or prescribed by industry standards are unacceptable.

Any and all cable(s) installed in violation of allowed methodology shall be removed and replaced with new cable(s) using correct methods at no cost to the City.

All cables shall be labeled in each handhole and at each termination point using pre-printed wrap-around cable labels, day-glow green (or orange). Labels shall be 4-inches by 4-inches, William Frick P/N WFS-ES-0004, or approved equivalent, and shall read "Pikeville Fiber Optic Cable," and shall identify the cable direction at each splice or termination point by indicating the next adjacent splice or site for each cable segment.

The Contractor shall supply fiber optic cable in accordance to the following specifications:

- Ribbon optical cable for backbone applications, containing 12-strand ribbons, conforming to international standards ITU-T G.652.D and Telcordia G-20.

- Loose buffer tube optical cable for service drop applications, containing 12-strand buffer tubes, in 12, 24, and 48-count sheaths, conforming to international standards ITU-T G.652.D and Telcordia G-20.
- Delivered on reels holding a contiguous fiber cable length of up to 20,000 feet. Pricing shall include return shipping of steel reels if used. The Contractor shall be expected to coordinate cable orders to ensure cable lengths are provided as needed support contiguous cable runs without splicing (not including mid-sheath splices) according to final designs.
- Comprised of All Dielectric (AD) materials.
- Comprised of a gel-free cable design incorporating dry water-blocking elements.
- Marked, in permanent white characters, with:
 - Manufacturer name
 - Month and year of manufacture
 - Number of optical fibers
 - Sequential length markings, minimum of every two feet, in feet

The Contractor shall supply and install the following fiber cable varieties meeting the above specifications:

Item #9a: 12-strand, loose buffer tube, outdoor cable

Item #9b: 12-strand, loose buffer tube, plenum-rated

Item #9c: 24-strand, loose buffer tube, outdoor cable

Item #9d: 48-strand, loose buffer tube, outdoor cable

Item #9e: 144-strand, ribbon, outdoor cable

Item #9f: 288-strand, ribbon, outdoor cable

Placement of fiber optic cable shall be invoiced according to lineal units of material placed, to include footages of slack loops installed. Slack loops shall be installed in each handhole to provide a minimum of 10-percent additional cable material compared to the physical route distance to facilitate maintenance and splicing, or as specified by City-supplied engineering drawings.

Item #10: Rodding and Roping of Existing Conduit

This item consists of the proofing of existing conduit between handhole locations. This includes pushing an appropriately-sized mandrel through the conduit to ensure that the conduit is intact and no damage to the conduit has occurred. A pull tape shall be supplied and installed after the mandrel is sent through the conduit. This item shall also include any site preparation necessary to complete the conduit validation such as pumping water from handholes or manholes as well as traffic management.

Any obstruction or other defect preventing the passage of the mandrel shall constitute a failure. All failures shall be immediately reported to the project manager.

Item #11: Removal of Fiber Optic Cable from Conduit

This item consists of removing one or more fiber optic cable(s) from existing conduits. All may be removed, or one or more cable(s) may remain. Hand pulling methods are required. Prior written approval by the City is required for the use of any power assisted method of pulling wire or cable(s) from conduit. A strain limiter/release element that will part if the strain exceeds 600 pounds shall be used between the pulling grip and the pulling medium.

Removed fiber optic cable shall be coiled, OTDR tested according to specification herein, and, if City-supplied, returned to the City.

2.3. Aerial Fiber Installation

Item #12: Installation of Down Guy and Anchor

This item shall consist of supplying and installing a down guy or sidewalk guy and anchors. The guy and anchor shall be installed according to all applicable electrical and safety codes.

Item #13: Relocation of Down Guy and Anchor

This item shall consist of moving the location of a down guy or sidewalk guy. The guy shall remain associated with the same pole, but the location of the anchor shall change.

Item #14: Removal of Down Guy and Anchor

This item consists of removing anchors, down guys or sidewalk guys, and guy wire protectors. The method of removal of the down guy is left to the discretion of the Contractors.

Item #15: Installation of Overhead Guy

This item consists of supplying and installing a pole-to-pole overhead guy. The guy wire shall be attached to the pole at the appropriate location on the pole to provide guying for the cable installed. The guy shall be installed according to all applicable electrical and safety codes.

Item #16: Relocation of Overhead Guy

This item shall consist of moving the location of an overhead guy. The guy shall remain associated with the same pole, but the location of the attachment shall change.

Item #17: Removal of Overhead Guy

This item consists of removing overhead guys. The method of removal of the overhead guy is left to the discretion of the Contractor.

Item #18: Installation of Messenger Wire

This item consists of installing a stranded steel messenger wire (also known as suspension strand) attachment along a pole line. The suspension strand shall be ¼-inch (6.6M) utility strength grade, class C galvanized steel.

Item #19: Installation of Aerial Fiber

This item consists of installing fiber optic cable on messenger wire (also referred to as suspension strand) and overlashing fiber optic cable where existing cables are present.

The lashing wire shall start and terminate on each span between poles. The end points shall be installed so that the lashing wire remains tensioned. At mid-span splices, the lashing wire shall terminate on each side of the splice. The lashing wire shall be grade 316 stainless steel with a .045-inch diameter and shall have the highest rated corrosion resistance.

All cables shall be labeled at each slack location and at each termination point using pre-printed wrap-around cable labels, day-glow green (or orange). Labels shall be 4-inches by 4-inches, William Frick P/N WFS-ES-0004, or approved equivalent, and shall read "Pikeville Fiber Optic Cable," and shall identify the cable direction at each splice or termination point by indicating the next adjacent splice or site for each cable segment.

The Contractor shall supply fiber optic cable in accordance to the following specifications:

- Ribbon optical cable for backbone applications, containing 12-strand ribbons, conforming to international standards ITU-T G.652.D and Telcordia G-20.
- Loose buffer tube optical cable for service drop applications, containing 12-strand buffer tubes, in 12, 24, and 48-count sheaths, conforming to international standards ITU-T G.652.D and Telcordia G-20.
- Delivered on reels holding a contiguous fiber cable length of up to 20,000 feet. Pricing shall include return shipping of steel reels if used. The Contractor shall be expected to coordinate cable orders to ensure cable lengths are provided as needed support contiguous cable runs without splicing (not including mid-sheath splices) according to final designs.
- Comprised of All Dielectric (AD) materials.
- Comprised of a gel-free cable design incorporating dry water-blocking elements.
- Marked, in permanent white characters, with:
 - Manufacturer name
 - Month and year of manufacture
 - Number of optical fibers
 - Sequential length markings, minimum of every two feet, in feet

The Contractor shall supply and install the following fiber cable varieties meeting the above specifications:

Item #19a: 12-strand, loose buffer tube, outdoor cable

Item #19b: 12-strand, loose buffer tube, plenum-rated

Item #19c: 24-strand, loose buffer tube, outdoor cable

Item #19d: 48-strand, loose buffer tube, outdoor cable

Item #19e: 144-strand, ribbon, outdoor cable

Item #19f: 288-strand, ribbon, outdoor cable

Placement of fiber optic cable shall be invoiced according to lineal units of material placed, to include footages of slack loops installed. Slack loops shall be installed in each snowshoes and provide a minimum of 10-percent additional cable material compared to the physical route distance to facilitate maintenance and splicing, or as specified by engineering drawings.

Item #20: Removal of Fiber Optic Cable from Strand (De-Lashing)

This item consists of removing fiber optic cable from strand wire.

The location of the fiber optic cable to be removed will be designated by the City. All tape holding cable to strand must be removed and disposed of properly. All lashing wire holding cable to strand must be removed and disposed of properly. The fiber optic cable must be completely removed from the strand and shall not be cut in shorter lengths as it is being removed. The removed fiber cable shall be coiled, OTDR-tested, and, if City-supplied, returned to the City unless otherwise stated.

2.4. Fiber Splicing and Testing

Item #21: Installation of New Straight-Through Splice Enclosure

This item consists of the supply and installation of a non-encapsulated, gasket-sealed splice enclosure, but does **not** include the actual strand splicing. The item includes the equipment setup, preparation of cable ends for splicing, and installing the splice enclosure in an underground handhole or on aerial strand for one or more cables containing up to 288 fiber strands.

Splice enclosures shall be suitable for splicing both ribbon and loose-tube fiber cable types. Each enclosure shall be provided with all necessary accessories and hardware, including splice trays, splice protection sleeves, cable retention hardware, port plugs/grommets, grounding accessories, and closure sealing accessories. The contractor shall supply fiber optic splice enclosures, including splice trays and related hardware, equipped for at least four feeder cables and a minimum of 288 mass fusion (ribbon) splices. Suitable enclosures include the Preformed Line Products COY 1-002 with LGSTR144 Trays, or equivalent.

Splice enclosure installation shall be in accordance with applicable standards and manufacturer instructions. All enclosures shall be tested in accordance with Telcordia GR-771-CORE.

Item #22 Installation of New Mid-Sheath Splice Enclosure (Ring Cut)

This item consists of the supply and installation of a non-encapsulated, gasket-sealed splice enclosure for a mid-sheath splice, but does **not** include the actual strand splicing.

This item allows access to one or more fibers for splicing without cutting the entire cable. It consists of cutting away a section of cable jacketing to expose the buffer tubes / ribbons, cutting or splitting open a buffer tube / ribbon (depending on whether there are active fibers), preparing the designated fibers for splicing, and installing a splice enclosure to house the exposed section of cable. It typically will be performed on backbone fiber to facilitate splicing to a new or existing lateral fiber cable, service drop cable, or fiber tap stub cable.

Care shall be taken not to cut any fibers that are in active use, and may require use of an active fiber identifier to verify strands not in-use before cutting strands. The work may include pulling fiber cable slack from adjacent handholes, and includes installing the splice enclosure in an underground pull box or vault for one or more cables containing up to 288 fiber strands.

Each enclosure shall be provided with all necessary accessories and hardware, including splice trays, splice protection sleeves, cable retention hardware, port plugs/grommets, grounding accessories, and closure sealing accessories. The contractor shall supply fiber optic splice enclosures, including splice trays and related hardware, equipped for at least six feeder cables / fiber tap stub cables and up to 144 individual (loose buffer tube) splices. Suitable enclosures include the Preformed Line Products 8006944 with 80809958 Trays, or equivalent.

Splice enclosures shall be provided equipped for the following splice capacities:

Item #22a: 72-strand, single splices (loose buffer tube)

Item #22b: 144-strand, single splices (loose buffer tube)

Splice enclosure installation shall be in accordance with applicable standards and manufacturer instructions. All enclosures shall be tested in accordance with Telcordia GR-771-CORE.

Item #23: Re-entry of an Existing Splice Enclosure

This item consists of reentering an existing non-encapsulated, gasket-sealed splice enclosure to make additional splices, installing a new gasket, and resealing the enclosure after the splice work has been completed.

Item #24: Fiber Splicing, Individual Strand (per strand)

This item consists of splicing individual ends of two ends of single-mode fiber strands, placing the fused fiber in a splice tray, and placing the tray in a splice enclosure, wall-mounted housings, or

rack-mounted housings. All fiber shall be fusion-spliced. Splices shall have an optical attenuation of no more than 0.1 dB at 1550 nm and 1310 nm.

Item #25: Fiber Splicing, Mass-Fusion (per ribbon)

This item consists of splicing two ends of ribbon fiber, consisting of 12 to 24 strands, placing the fused fiber in a splice tray, and placing the tray in a splice enclosure, wall-mounted housings, or rack-mounted housings. All fiber shall be fusion-spliced. Splices shall have an optical attenuation of no more than 0.1 dB at 1550 nm and 1310 nm.

Item #26: OTDR Testing of Un-Terminated Backbone Cable

This item consists of bi-directional OTDR testing of an un-terminated, installed fiber optic cable, requiring the use of bare fiber adapters prior to termination. Pricing shall be provided on a per strand basis for backbone cables ranging from 144-count to 288-count.

All fiber strands shall be tested using an OTDR at 1310 nm and 1550 nm, and documented according to the specifications in Section 1.5.

Contractor shall be responsible for reporting test results to the City in an agreed format.

Item #27: OTDR Testing of Un-terminated Lateral Cable

This item consists of bi-directional OTDR testing of an un-terminated, installed fiber optic cable, requiring the use of bare fiber adapters. Pricing shall be provided on a per strand basis for lateral cables ranging from 12-count to 96-count.

All fiber strands shall be tested using an OTDR at 1310 nm and 1550 nm, and documented according to the specifications in Section 1.5.

Item #28: Final Acceptance Testing of Terminated cable

This item consists of bi-directional OTDR and power meter testing installed fiber optic cable, terminated on both ends. Pricing shall be provided on a per strand basis.

All fiber strands shall be tested at 1310 nm and 1550 nm, and documented according to the specifications in Section 1.5.

2.5. Fiber Termination and Inside Plant Work

Item #29: Installation of Backbone Termination Panel

This item consists of the supply and installation of a rack mounted fiber termination panel, typically for fiber cable strand counts of up to 288. This item includes any required assembly of the termination housing/frame, rack mounting the housing/frame, installation of splice trays, installation of connector modules and pigtails, installation of cable management hardware, and proper labeling of fiber ports.

This item does not include fiber splicing.

The Contractor shall supply a single termination panel equipped to support the termination of 288 fiber strands using LC/UPC duplex connectors. The termination panel housing shall be designed for rack-mounting, and shall occupy no more than 4 RU (7-inches) of vertical rack space for connector housings, not including storage for splice trays and cable management.

The panel shall be provided with all necessary splice trays, cable management/strain relief, mounting hardware, and related accessories necessary to accept and terminate an entire 288-count ribbon fiber cable.

The proposed solution may include the Corning CCH-04U using the CCH-CS24-A9-P00RE splice cassettes, and related accessories.

Item #30: Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated

This item consists of the supply and installation of innerduct along a path between the building entry point of the outdoor conduit and the fiber termination location internal to the building. The innerduct path may consist of placement in an existing conduit or affixed to ceiling or wall structure, within a plenum above a drop ceiling or below a raised floor.

The Contractor shall rod existing conduit where applicable to ensure that it is free of any obstructions before installing an innerduct.

Supplied innerduct shall be high-density polyethylene (HDPE) innerduct. All innerduct shall contain a pre-installed 900-pound polyester pull tape, and shall have the following characteristics:

- Corrugated construction, orange
- 1.38-inch nominal inner diameter
- 0.035-inch minimum wall thickness
- Plenum rated and UL listed to UL910
- Tensile pulling strength: 319 pounds
- Color: orange
- Carlon CG4X1Cxxxx, or approved equivalent.

Item #31: Installation of Fiber Optic Taps within Handholes

This item consists of the supply and proper mounting of fiber optic tap assemblies (e.g. Corning Optitap-style connector housings), within underground enclosures. Mounting shall be performed according to manufacturer instructions using manufacturer-provided mounting

hardware. This item includes placement of the stub cable and any associated slack loops within underground conduit and handholes.

This item consists of fiber optic tap assemblies having the following properties:

- Single buffer tube stub cable of varying lengths
- Tested to Telcordia GR-771-CORE standards
- Singlemode fiber meeting ITU-T G.652.D specifications
- Multiple ports compatible with Corning OptiTap®, SC-APC connectors
- Environmentally hardened, designed for outdoor installation (underground or aerial installation)

Fiber Optic Tap Assemblies shall be the Corning OptiSheath® MultiPort Terminal, or equivalent, and shall be provided in the following varieties:

- Item #31a: Fiber Tap Assembly, 4-port, 100-foot stub**
- Item #31b: Fiber Tap Assembly, 4-port, 200-foot stub**
- Item #31c: Fiber Tap Assembly, 4-port, 280-foot stub**
- Item #31d: Fiber Tap Assembly, 4-port, 400-foot stub**
- Item #31e: Fiber Tap Assembly, 4-port, 500-foot stub**
- Item #31f: Fiber Tap Assembly, 4-port, 600-foot stub**
- Item #31g: Fiber Tap Assembly, 4-port, 800-foot stub**
- Item #31h: Fiber Tap Assembly, 6-port, 100-foot stub**
- Item #31i: Fiber Tap Assembly, 6-port, 200-foot stub**
- Item #31j: Fiber Tap Assembly, 6-port, 280-foot stub**
- Item #31k: Fiber Tap Assembly, 6-port, 400-foot stub**
- Item #31l: Fiber Tap Assembly, 6-port, 500-foot stub**
- Item #31m: Fiber Tap Assembly, 6-port, 600-foot stub**
- Item #31n: Fiber Tap Assembly, 6-port, 700-foot stub**
- Item #31o: Fiber Tap Assembly, 8-port, 100-foot stub**
- Item #31p: Fiber Tap Assembly, 8-port, 200-foot stub**
- Item #31q: Fiber Tap Assembly, 8-port, 280-foot stub**
- Item #31r: Fiber Tap Assembly, 8-port, 400-foot stub**
- Item #31s: Fiber Tap Assembly, 8-port, 500-foot stub**
- Item #31t: Fiber Tap Assembly, 8-port, 600-foot stub**
- Item #31u: Fiber Tap Assembly, 8-port, 700-foot stub**
- Item #31v: Fiber Tap Assembly, 12-port, 200-foot stub**
- Item #31w: Fiber Tap Assembly, 12-port, 280-foot stub**
- Item #31x: Fiber Tap Assembly, 12-port, 400-foot stub**
- Item #31y: Fiber Tap Assembly, 12-port, 600-foot stub**
- Item #31z: Fiber Tap Assembly, 12-port, 800-foot stub**

Item #32: Installation of Lateral Termination Panel

This item consists of the supply and installation of a wall-mounted or rack-mounted fiber termination panel, typically for fiber strand counts of 12 to 96. This item includes any required assembly of the termination housing/frame, mounting the housing/frame (including mounting a plywood backboard where required), installation of splice trays, installation of connector modules and pigtails, installation of cable management hardware, and proper labeling of fiber ports.

This item does not include fiber splicing.

The Contractor shall supply fiber termination (patch) panels, each equipped with the appropriate number of bulkhead connector panels, fusion splicing trays, strain relief accessories, and rack-mounting hardware (if applicable). All panels shall include accessories for cable management and protection of splicing to outside plant cable in the space behind or inside of the panel housing. Panels designed for both wall-mounting and rack-mounting shall be provided.

Panels supporting greater than 48 fibers may have the splicing storage and handling space provided in a physically separate, but integrated housing.

Item #32a: Lateral Termination Panel, rack-mount, 12-strands

The Contractor shall supply and install a single termination panel equipped to support the termination of 12 fiber strands, scalable to 24 fiber strands. The termination panel housing shall be designed for rack-mounting in a standard 19-inch equipment rack or enclosure, and shall occupy no more than 1 RU (rack unit, 1.75-inches) of vertical rack space. The panel shall include 12 fiber pigtailed terminated with LC/UPC connectors, 12 LC/UPC bulkhead connectors, bulkhead panel/module, splice tray, and related cable management accessories.

This item shall be the Corning PCH-01U, or equivalent, consisting of the following:

- One (1) each, Corning PCH-01U Pretium Connector Housing Patch Panel
- One (1) each, Corning PC1-SPLC-04R – Splice Tray Bracket for PCH-01U
- One (1) each, Corning CCH-CP12-A9 – 12 port, duplex, singlemode LC-UPC connector panel
- Twelve (12) each, LC/UPC fiber pigtail, preterminated, 2 meter
- One (1) each, Corning M67-110 Type 4R splice tray
- All required cable management and mounting accessories.

Item #32b: Lateral Termination Panel, wall-mount, 12-strands

The Contractor shall supply and install a single termination panel equipped to support the termination of 12 fiber strands, scalable to 24 fiber strands. The termination panel housing shall be designed for wall-mounting, and shall provide a lockable door to protect splice trays and fiber pigtailed. The panel shall include 12 fiber pigtailed terminated with LC/UPC connectors, 12 LC/UPC bulkhead connectors, bulkhead panel/module, splice tray, and related cable management accessories.

This item shall be the Corning PWH-02P, or equivalent, consisting of the following:

- One (1) each, Corning PWH-02P Pretium Connector Housing Patch Panel
- One (1) each, Corning HDWR-LOCK-KIT, lock kit for PWH-02P housing
- One (1) each, Corning PWH-SPLC-04-12P – Splice Tray Bracket for PWH-02P
- One (1) each, Corning CCH-CP12-A9 – 12 port, duplex, singlemode LC-UPC connector panel
- Twelve (12) each, LC/UPC fiber pigtail, preterminated, 2 meter
- One (1) each, Corning M67-110 Type 4R splice tray
- All required cable management and mounting accessories.

Item #32c: Lateral Termination Panel, rack-mount, 24-strands

The Contractor shall supply and install a single termination panel equipped to support the termination of 24 fiber strands. The termination panel housing shall be designed for rack-mounting in a standard 19-inch equipment rack or enclosure, and shall occupy no more than 1 RU (rack unit, 1.75-inches) of vertical rack space. The panel shall include 24 fiber pigtails terminated with LC/UPC connectors, 24 LC/UPC bulkhead connectors, bulkhead panel/module, splice tray, and related cable management accessories.

This item shall be the Corning PCH-01U, or equivalent, consisting of the following:

- One (1) each, Corning PCH-01U Pretium Connector Housing Patch Panel
- One (1) each, Corning PC1-SPLC-04R – Splice Tray Bracket for PCH-01U
- Two (2) each, Corning CCH-CP12-A9 – 12 port, duplex, singlemode LC-UPC connector panel
- 24 each, LC/UPC fiber pigtail, preterminated, 2 meter
- Two (2) each, Corning M67-110 Type 4R splice tray
- All required cable management and mounting accessories.

Item 33: Installation of individual FTTP Service Drop Cable

This item consists of the supply and installation of pre-connectorized service drop cables in conduit between installed Fiber Optic Taps and a demarcation point within the customer premises. The Contractor shall pull the drop cable to a demarcation point along an exterior wall of a single family or attached residence or business building, and shall secure a service loop of approximately 50 feet in length to the building exterior.

This item does not include underground conduit placement.

Service drop cables shall be connectorized on one end with Corning OptiTap-style connectors for interfacing with installed fiber taps. Drop cables shall be Corning 004301EB4FDxxxF, or equivalent, and provided in the following varieties:

Item #33a: Service Drop Cable, SC-APC, 250 foot

Item #33b: Service Drop Cable, SC-APC, 500 foot

2.6. Locating Services

Item #34: Fiber Locating Services

For this item the Contractor shall receive, and respond as required by law, to all excavation notices directed to the City. Each locate must be worked and a positive response given within the time frame required by law. The City will strictly enforce any mandatory time limit. For the purpose of safeguarding City subsurface facilities from excavation damage, Contractor shall provide such temporary markings or protection as may be required. The City reserves the right, with the full cooperation of Contractor to monitor the performance of this Agreement. Contractor failure to accurately locate facilities within the timeframe required by law will not be paid for by the City. In the event of damage to any facilities, where the Contractor is at fault, the Contractor will be responsible for any costs associated with the damages as well as any locate and/or re-locate costs.

The Contractor shall provide locate services for the following instances:

Item #34a: Standard Locate Request

This item consists of the Contractor completing/closing a locate ticket of (0-1500 feet) in the service areas that are assigned during weekday business hours (excludes weekend and holidays).

Item #34b: Standard Clear No Conflict

This item consists of the Contractor has reporting to a locate request area and determining there are no City facilities to be marked and completes the locate request by coding the ticket request as "No Conflict".

Item #34c: Additional Unit Charge

This item consists of the additional amount the Contractor will charge for completing/closing a locate ticket request beyond Standard Locate (in 1500 foot increments).

Item #34d: Emergency Out of Hours Unit

This item consists of the additional amount the Contractor will charge for completing/closing a locate ticket request outside of normal business hours (7am-5pm) weekdays, weekends and holidays.

3. Network Electronics Requirements

Figure 4 (below) shows a logical representation of the high-level FTTP network architecture the City requires. This design is open to a variety of network electronics options. The drawing illustrates the primary functional components in the FTTP network, their relative position to one another, and the flexibility of the architecture to support multiple subscriber models and classes of service.

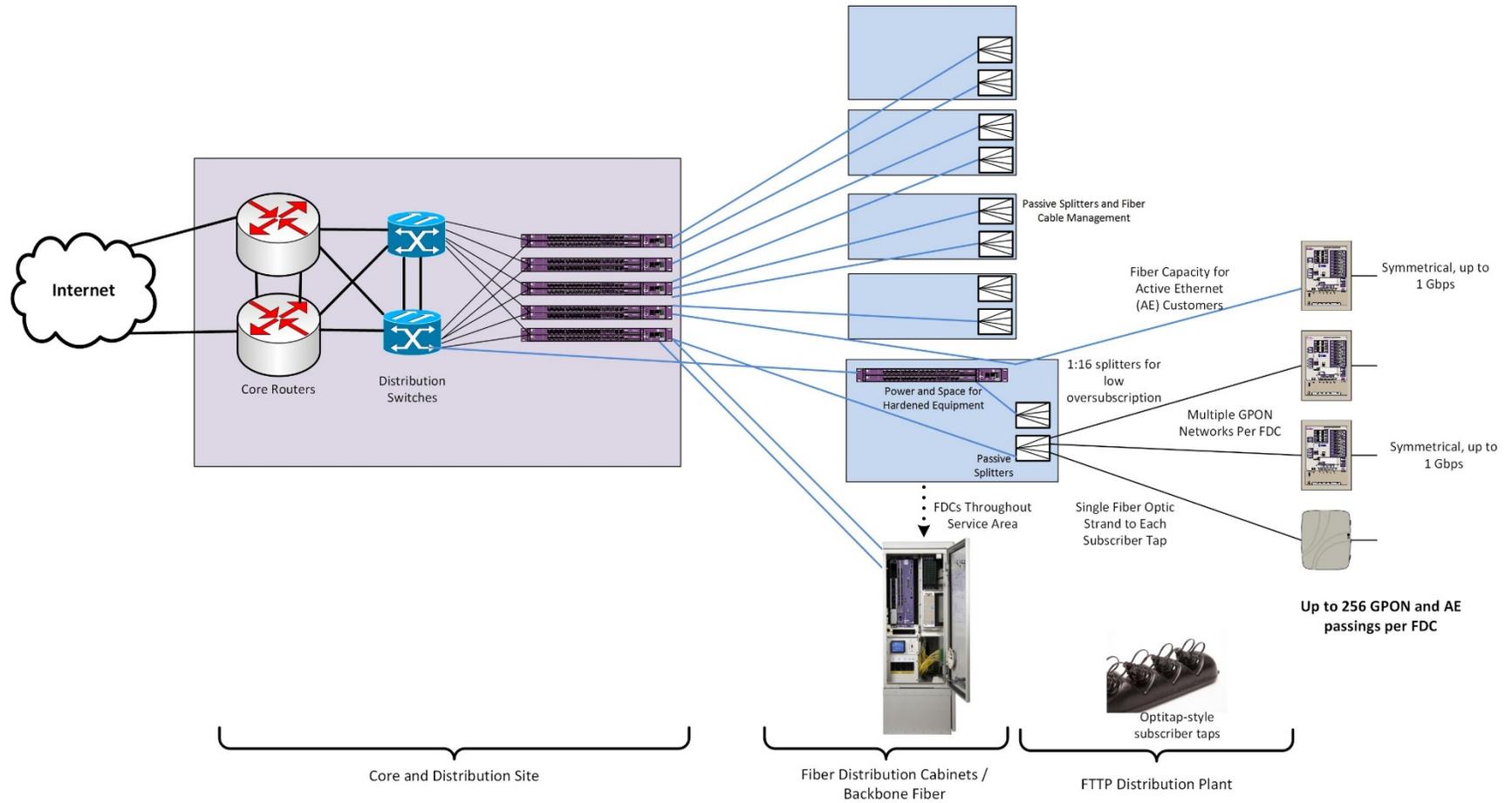
The Contractor shall provide a hierarchical data network that provides critical scalability and flexibility, both in terms of initial network deployment and its ability to accommodate the increased demands of future applications and technologies. The characteristics of this hierarchical FTTP data network shall be:

- Capacity – ability to provide efficient transport for subscriber data, even at peak levels
- Availability – high levels of redundancy, reliability, and resiliency; ability to quickly detect faults and re-route traffic
- Diversity – physical path diversity to minimize operational impact resulting from fiber or equipment failure
- Efficiency – no traffic bottlenecks; efficient use of resources
- Scalability – ability to grow in terms of physical service area and increased data capacity, and to integrate newer technologies
- Manageability – simplified provisioning and management of subscribers and services
- Flexibility – ability to provide different levels and classes of service to different customer environments; can support an open access network or a single-provider network; can provide separation between service providers on the physical layer (separate fibers) or logical layer (separate VLAN or VPN)
- Security – controlled physical access to all equipment and facilities, plus network access control to devices

This architecture offers scalability to meet long-term needs. It is consistent with best practices for an open access network model that might potentially be required to support multiple network operators, or at least multiple retail service providers requiring dedicated connections to certain customers. This design shall support a combination of Gigabit Passive Optical Network (GPON) and direct Active Ethernet services (with the addition of electronics at the fiber distribution cabinets), which would enable the network to scale by migrating to direct connections to each customer, or reducing splitter ratios, on an as-needed basis.

The design assumes placement of manufacturer-terminated fiber tap enclosures within the right-of-way or easements, providing water-tight fiber connectors for customer service drop cables and eliminating the need for service installers to perform splices in the field. The model also assumes the termination of standard lateral fiber connections within larger multi-tenant business locations and multi-dwelling units.

Figure 4: High-Level FTTP Architecture



The core location in this plan shall include core routers, distribution switches, and Operational Support Systems (OSS) such as provisioning platforms, fault and performance management systems, remote access, and other operational support systems for FTTP operations. The core location is also where any business partner or content / service providers will gain access to the subscriber network with their own points-of-presence.

The core location shall run in a High Availability (HA) configuration, with fully meshed and redundant uplinks to the public Internet and/or all other content and service providers. It is imperative that the core network location be physically secure and allow unencumbered access 24x7x365 to authorized engineering and operational staff.

The operational environment of the network core shall be similar to that of a data center. It shall include uninterruptible power source (UPS) batteries, and diesel power generation for survival through sustained commercial outages. The facility shall have strong physical security, limited/controlled access, and environmental controls for humidity and temperature, and fire suppression systems.

Equipment shall be mounted securely in racks and cabinets, in compliance with national, state, and local codes. All equipment shall be connected with uninterrupted cutover to battery and generation.

The Contractor shall construct sufficient fiber distribution cabinets (FDCs) to support higher than anticipated levels of subscriber penetration. The approach shall accommodate future subscriber growth with minimal re-engineering. Passive optical splitters shall be modular so that they can be added to an existing FDC as required to support subscriber growth, or to accommodate unanticipated changes to the fiber distribution network with potential future technologies.

The City recommends that the Contractor use GPON electronics for the majority of subscribers and Active Ethernet for a small percentage of subscribers (typically business customers) that request a premium service or require greater bandwidth.

The network shall be constructed so that it can accommodate increases in capacity without additional outside plant construction. Potential upgrade roadmaps shall include the following:

1. Reducing the number of premises in a PON segment by modifying the splitter assignment and adding optics. For example, by reducing the split from 16:1 to 4:1, the per-user capacity in the access portion of the network is quadrupled.
2. Adding higher speed PON protocols by adding electronics at the FDC or hub locations. Since these use different frequencies than the GPON electronics, none of the CPE would need to be replaced.
3. Adding WDM-PON electronics as they become widely available. This will enable each user to have the same capacity as an entire PON. Again, these use different frequencies than GPON and are not expected to require replacement of legacy CPE equipment.

All GPON OLT hardware shall have fully redundant, hot-swappable common components (control cards/processors, power supplies, etc.), as well as multiple 10 GE / GE uplink interfaces capable of supporting Layer-2 link aggregation.

The supplied hardware shall meet the following baseline specifications.

3.1. Optical Line Terminal (OLT)

- Fully redundant, hot swappable common components (control cards/processors, power supplies, etc.)
- Modular chassis design supporting ITU G.984-compliant GPON interfaces
- GPON line cards utilizing small form factor pluggable (SFP) GPON optical interfaces
- Support for IEEE 802.3ad/802.1AX link aggregation on all uplink ports
- Support for IEEE 802.1Q VLANs
- Support for IEEE 802.1p QoS (minimum four traffic classes)
- SNMP management
- Spare GPON line card for N+1 cold-standby redundancy and at least one each of the GE uplink and GPON SFP optics (i.e. all non-redundant components).

3.2. Optical Network Terminal (ONT)

- ITU G.984-compliant GPON interface (Class B+ optics)
- Minimum of one 10/100/1000Base-TX interface
- Support for IEEE 802.1Q VLANs
- Support for IEEE 802.1p QoS (minimum four traffic classes)
- Inputs for DC backup power supply
- SNMP management and alarms

Respondents are encouraged to describe any competitive advantages of the proposed products and configuration beyond these baseline requirements.

4. Fiber Optic Broadband Service Requirements

Respondent shall construct and operate an FTTP Network capable of providing voice, video, at least 1 Gbps Internet and fiber services to residential and business consumers. The respondent's network would ensure not only that the City becomes a "Gigabit Community", but also that its status keeps pace with advances in networking and connectivity speeds.

Respondent shall provide a high level of service to all customers, as judged by prevailing industry standards. Respondent shall design and operate its Network so that it meets advertised service levels consistently.

4.1. Residential Services

Respondent shall provide the following services to residential consumers in the City utilizing the FTTP Network:

- (1) **Fiber Internet.** Internet speeds up to and including, but not limited to 1 Gbps. Respondent shall provide the option of symmetrical service. Respondent also agrees not to impose caps on the amount of data transmitted or received by a given customer during a particular period of time, nor selectively impose variable data rates or other similar traffic management techniques upon a given customer reaching certain data transfer thresholds.
- (2) **Pricing.** Gigabit service shall be available at a comparable rate to other US gigabit-fiber communities.
- (3) **Wireless Home Networking.** Respondent shall provide the ability to connect computers and other customer-owned devices wirelessly to Respondent's Internet service using state-of-the-art Wi-Fi technology (currently 802.11ac) without limitation on the number of customer devices.
- (4) **New Services.** As new residential broadband services, such as smart home, distance learning, tele-medicine and 4K video become market ready, Respondent's dedicated product development team shall work to make those services available and Respondent commits to keeping pace with the cutting edge of the competitive FTTP industry.
- (5) **Residential Dark Fiber.** Respondent shall provide the option for a resident to lease dark fiber from the premises to a meet point with an outside provider, or to another residence or business on the network.

4.2. Business Services

Respondent shall offer the following services to business consumers in the City utilizing the FTTP Network:

- (1) **Fiber Internet.** Business services shall include symmetrical or close-to-symmetrical services starting 1 Gbps and 10 Gbps and increasing with the evolution of demand and technology. Respondent also agrees not to impose caps on bandwidth.
- (2) **Business Dark Fiber.** Respondent will provide the option for a business to lease dark fiber from the premises to a meet point with an outside provider, or to another residence or business on the network. Businesses may also connect to the Respondent's Business Dark Fiber or Open Access ISP Dark Fiber customers
- (3) **Enterprise Solutions.** Enterprise solutions including competitively priced dark fiber, Metro-Ethernet and/or Virtual Private Network (VPN) services, local area networks and high capacity point-to-point and point-to-multipoint circuits for commercial customers.

4.3. Network Performance Standards

Contractor shall adhere to the following credit schedule (outside force majeure conditions):

- 98.0% to 98.9% uptime: 15% of monthly fees paid returned to customers
- 97.0% to 97.9% uptime: 30% of monthly fees paid returned to customers
- 96.0% to 96.9% uptime: 40% of monthly fees paid returned to customers
- Below 96%: 50% of monthly fees paid returned to customers