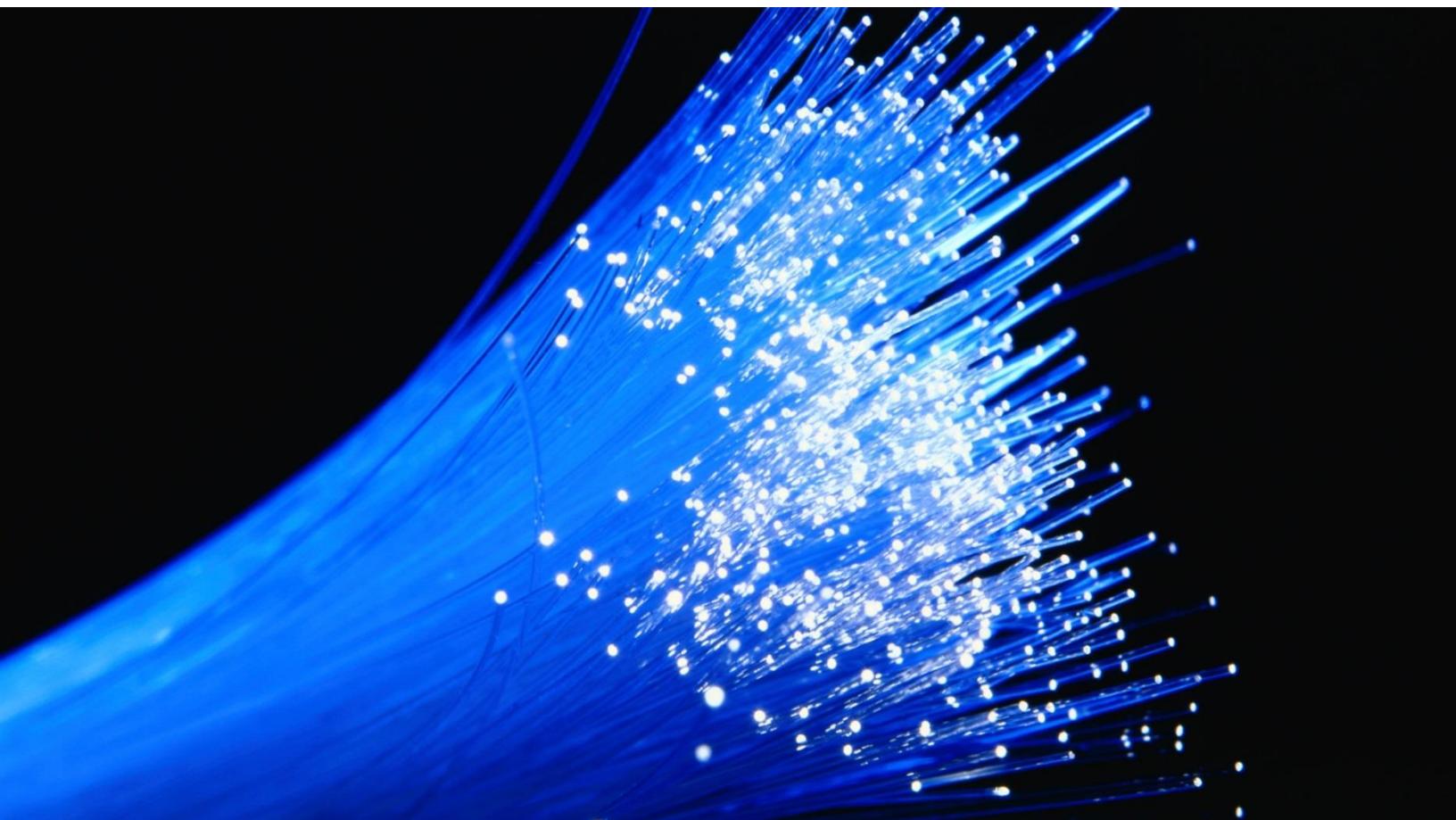


# ctc technology & energy

engineering & business consulting



## Strategies for Improving Broadband Service in Wildwood

Prepared for the City of Wildwood, Missouri  
September 2019

Columbia Telecommunications Corporation

10613 Concord Street • Kensington, MD 20895 • Tel: 301-933-1488 • Fax: 301-933-3340 • [www.ctcnet.us](http://www.ctcnet.us)

## Contents

1	Executive Summary.....	1
1.1	Observations and Recommendations .....	2
1.2	Evaluation of Available City Infrastructure .....	6
2	Engagement with Potential Partners.....	8
2.1	The Role of Ameren.....	9
3	Conceptual Fiber Network Design and Cost Estimates .....	11
3.1	Survey Methodology for Developing Design and Cost Estimates.....	12
3.2	Fiber-to-the-Premises Network Design.....	15
3.2.1	Network Design.....	18
3.2.2	Network Core and Hub Site .....	21
3.2.3	Distribution and Access Network Design.....	23
3.3	Dark Fiber-to-the-Premises Cost Estimate.....	26
3.4	Lit Fiber-to-the-Premises Cost Estimate .....	27
3.4.1	Cost per Passing .....	27
3.4.2	OSP Cost Estimation Methodology.....	29
3.4.3	OSP Costs .....	32
3.4.4	Central Network Electronics Costs.....	35
3.4.5	Customer Premises Equipment and Service Drop Installation (Per Subscriber Costs)	
	36	
3.4.1	Cost Estimate Assumptions .....	37
4	Approaches and Business Models .....	39
4.1	Overview of Models .....	39
4.2	Advantages and Disadvantages of the Models .....	42
5	Funding and Financing Strategies .....	43
5.1	Options for Bonds and Other Loans.....	43
5.1.1	General Obligation Bonds .....	43
5.1.2	Revenue Bonds .....	44
5.2	Potential for Grant Funding .....	44
5.3	Wildwood Is Not Eligible for Most Broadband Funding Opportunities at This Time ....	45

5.3.1	USDA ReConnect.....	46
5.3.2	USDA Community Connect .....	46
5.3.3	Economic Development Administration.....	46
5.3.4	USAC – E-rate .....	47
5.3.5	USAC – Healthcare Connect Fund.....	48
6	Middle Mile and Dark FTTP Financial Analysis .....	49
6.1	Middle Mile Cost of Ownership .....	49
6.1.1	Operations and Maintenance Expenses .....	49
6.1.2	Financing Costs .....	50
6.2	Dark FTTP Cost of Ownership.....	50
6.3	Dark FTTP Cost of Ownership.....	51
	Appendix A: A Cooperative Model .....	53
	Appendix B: Advantages and Disadvantages of All Models .....	54
	Appendix C: Middle Mile Financial Model.....	55
	Appendix D: Dark FTTP Financial Model.....	56
	Appendix E: Fiber Cost Estimate .....	57

## Tables

Table 1: Summary of High, Medium, and Low Density Areas	4
Table 2: Field Survey Findings	12
Table 3: Estimated Dark FTTP Cost with Drops (Assuming a 35 Percent Take Rate)	26
Table 4: Estimated Lit FTTP Cost	27
Table 5: Estimated OSP Costs	33
Table 6: Estimated Central Network Electronics Costs	35
Table 7: Per Subscriber Cost Estimates	37
Table 8: Cost Estimate Assumptions	38
Table 9: FTTP Approaches	40
Table 10: Middle-Mile and Incentive Approaches	41
Table 11: Middle Mile Fiber Network Operating and Maintenance (O&M) Expenses	50

## Figures

Figure 1: High, Medium, and Low Household Densities	3
Figure 2: Utility Pole Line Showing where Tree Trimming is Needed	13
Figure 3: Congested Pole where Make-Ready will be Required	14
Figure 4: Example of Low Make-Ready Pole Lines	15
Figure 5: High-Level FTTP Architecture	17
Figure 6: FTTP Network Example Backbone (Middle-Mile) Design	19
Figure 7: Sample FTTP Access Layer Design	21
Figure 8: Sample Hub Facility	22
Figure 9: Fiber Distribution Cabinet	24
Figure 10: Demarcation Between City and Partner Network Elements in the Lit and Dark Models	27
Figure 11: FTTP Cost per Passing Comparison	28
Figure 12: FTTP Key Cost Factors (Density and Construction Cost)	28
Figure 13: Total Estimated Cost versus Take Rate	29
Figure 14: Map of the Sample Design	31
Figure 15: Demarcation Between City and Partner Network Elements (Huntsville Model)	51

## 1 Executive Summary

The City of Wildwood, Missouri (City) faces supply constraints on the provision of high-speed broadband access. In particular, residents on the west side of the City have limited—if any—broadband choices. The City engaged CTC Technology & Energy (CTC) to explore options for addressing the City’s broadband deficits and has stated a willingness to potentially commit some public funds to deploying broadband infrastructure so long as this funding supports scalable, futureproof, tangible assets that make the most difference to the largest number of people.

### 1.1 Report Overview

This study provides:

- A range of approaches and alternatives to addressing the City’s broadband gap, and a discussion of which ones are most practical.
- Designs for a fiber-to-the-premises (FTTP) network serving the whole City, an FTTP network in just the western part of the City, a middle-mile network to encourage “last mile” investment to homes by internet service providers (ISP) and wireless ISPs (WISPS), and buildouts in three representative neighborhoods.
- Capital and operating costs for each of the above fiber designs, and potential sources of funding: public (the City); private (ISP or WISP); and homeowners or homeowner associations (HOA).
- Potential financing methods and financial security requirements.
- An initial exploration of interest on the part of local ISPs and WISPS in participating, and in what roles.
- An outline of the parameters under which Ameren, the electric utility, will help facilitate a buildup, including to allow attachments on its poles.
- Options for how ownership and operational responsibilities are split among the three categories of stakeholders (City, ISP/WISP, and homeowner), based on the identified costs and sources of funding, subject to a legal review.

### 1.2 Key Findings

Our report’s findings are summarized in these points:

1. **The cost of building an FTTP network is very high:** about \$59 million for the “outside plant” alone, plus the costs of “drops” from the street to the premises (another \$10 million if 35 percent of residents take service). This high cost is driven largely by the cost

of providing last-mile service in sparsely developed parts of the City. It is apparent that an expense of this magnitude is not feasible for the City.

2. **The City could potentially build a backbone (often called a “middle-mile”) fiber network at a cost of about \$4.3 million and seek to bring in private providers to deliver last-mile service.** The private ISPs could use a hybrid of FTTP and wireless solutions. This option would certainly be less expensive than building a full FTTP network but comes with no guarantees that private providers will actually step up to provide near-ubiquitous service. (The City could build a more-extensive middle-mile network, but the costs will rise sharply.) Section 4 spells out business model variations on these options, but the core options and cost magnitudes are roughly the same.
3. **As an alternative, the City could consider an incentive approach, and issue a request for proposals that encourages ISPs to develop plans for providing near-ubiquitous service.** The RFP would need to be structured to allow ISPs to respond by stating in detail what they are willing to do and what incentive they would require to proceed. The City would then review the proposals and engage in a negotiation process. We estimate in this report that incentives of \$2.5 million to \$3.5 million might be required. The final subsidy number could be higher or lower than the bounds of this range.

### 1.3 Observations and Recommendations

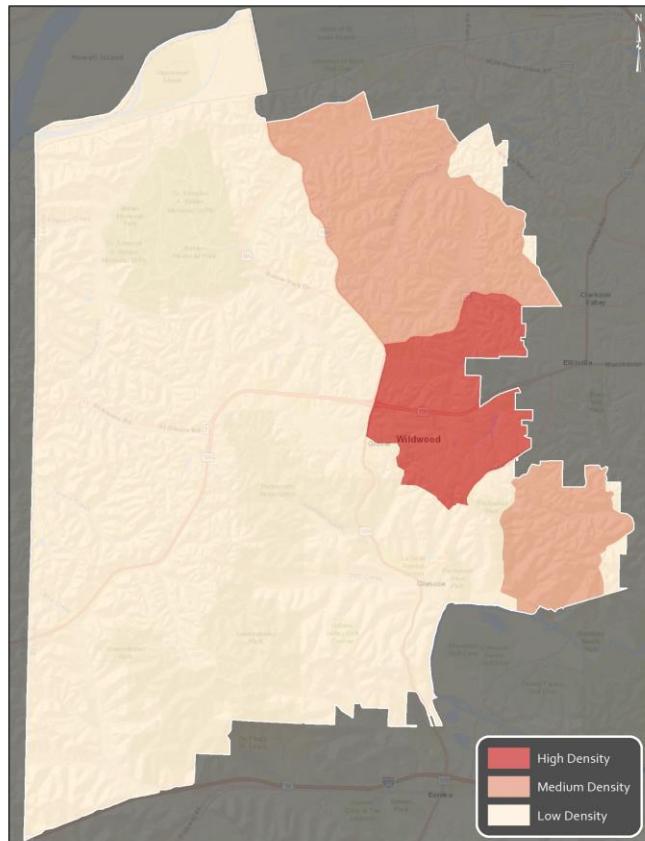
During the process of developing the report we received input from the City’s leadership. Among other things, they noted that several residents have indicated that they receive excellent wireless broadband service—thus potentially calling in to question the need for additional broadband infrastructure investment. In response we note that the residents of Wildwood who receive excellent wireless service are receiving it because they happen to live in an area where it is technically feasible and cost-effective for local ISPs to provide this service. Similar service is not available everywhere in Wildwood due to technical challenges related to wireless propagation—for example, in the western portion of the City. There is also no wireless solution that magically solves the problem of providing near-ubiquitous service at a lower cost than fiber. Although a wireless deployment is less expensive than fiber initially, wireless solutions result in uneven service quality—and some service gaps—and entail higher operating costs over time.

The reasons for the City’s broadband deficits are simple: The cost of fiber construction is extremely high, and wireless coverage is challenging. This is the result of a combination of factors: low development density, long driveways, requirements for underground construction, hard rock in the soil, and topography. In short, ISPs cannot provide ubiquitous coverage and obtain a reasonable rate of return.

There are some ways to reduce broadband construction costs, such as by using internal crews rather than contractors. Such steps will help, but not come close to solving the cost issue. And while wireless expansion has helped in some areas it will not result in coverage that is both ubiquitous and robust. The WISPs operating in Wildwood—Bayes ET and Wisper—have indicated that wireless is not the long-term or comprehensive solution in Wildwood.

Population density tells part of the story. The high, medium, and low household density areas of the City are shown in Figure 1.

**Figure 1: High, Medium, and Low Household Densities**



As seen in Table 1 there is more than a seven-fold difference in the number of households passed (passings) per mile between the high-density and low-density areas of the City. The differences in the densities is the key driver in the cost to build and the reason why most portions of the high- and medium-density areas are served while the majority of the low-density areas remain unserved.

**Table 1: Summary of High-, Medium-, and Low-Density Areas**

Attribute	High Density	Medium Density	Low Density
Street Miles	59.33	79.88	259.67
Total Passings (households)	5,904	3,544	3,473
Average Passings per Mile (PPM)	99.51	44.37	13.37
Median PPM	101.82	44.37	13.37

To deliver more robust broadband for most of Wildwood a FTTP or hybrid fiber-coaxial (HFC) buildout is required, with wireless solutions perhaps deployed on a case-by-case basis for particularly hard-to-reach premises. (If Spectrum were to expand into the west side of the City, they would use HFC because this is their existing network platform. If another ISP were to build, it would most likely use FTTP.) From Wildwood's perspective, working with a smaller ISP would allow more control, but would entail some risk that the provider cannot scale to maintain the system as subscribers and infrastructure are added. A larger company like Spectrum would be less likely to face such difficulty, but the tradeoff for the City or homeowners is that they would have less control.

Solving the cost problem will require some kind of subsidy. Otherwise, ISPs will tend to serve only those areas of the west side where their costs of construction are lower, or where they can serve a location wirelessly. In other areas, ISPs or other providers will not perform a buildout unless funding is made available. Potential sources of funds include:

- **Investment funding from an ISP.** However, the ISP will need a rate of return on the investment. The City of Wildwood cannot expect an ISP to fund a project that does not provide a reasonable rate of return.
- **Contribution from the City.** The City should not expect a recovery of these funds in the short or long term.
- **Contribution from residents (homeowner's associations, individual groups, others).** Residents should not expect a recovery of these funds in the short or long term. However, an indirect benefit to homeowners is the potential for increased home value and faster resale once a robust broadband connection is in place.
- **Grants, if any are available.** Unfortunately, it does not appear that Wildwood is eligible for any current federal or other grant programs.

CTC examined eight approaches to solving these problems; these are described in Section 4. Of the eight, three appear the most reasonable:

**1: City Builds and Leases Dark Middle-Mile Fiber.** Under this scenario, the City would build middle-mile fiber—that is, the fiber running along main roads leading to neighborhoods—and provide ISPs access to this fiber. (We note that for a ubiquitous buildout, the middle-mile portion represents a low percentage of the total cost.) The ISPs would then deploy, own, and operate last-mile fiber—that is, the fiber on neighborhood streets to individual homes—as well as the electronics on the network, and provide retail services.

A disadvantage of this approach is that it allows providers to connect neighborhoods on a case-by-case basis, meaning that neighborhoods in which build costs are highest may still not be served.<sup>1</sup> An advantage is that this may provide a relatively fast solution and relatively low-cost way to solve the problem—at least in neighborhoods where the cost of construction is lowest.

In many neighborhoods, residents will need to contribute to the cost. And when residents help subsidize the cost to build the last-mile infrastructure, they may prefer to own the fiber, or indeed prefer to avoid owning the fiber. A variety of approaches and models could be considered. And if the residents prefer to own the fiber, one possible approach is that the ISP could form a cooperative with the neighborhood. An example of such a cooperative model is provided in Appendix A.

Bays ET suggested a variation on the above approach in which the City just installs conduit, then Bays ET (or another provider selected following an RFP process) pulls fiber when required. This would reduce the City's implementation and operation costs but might limit attractiveness to other ISPs. From a control and protection perspective, the City might be better served with owning and controlling both the middle-mile fiber and conduit.

**2: City Offers Cash Incentives.** Under this scenario, the City would issue an RFP offering funds for any ISP willing to provide broadband coverage guarantees as specified in the RFP. This approach has the potential of meeting core objectives—availability on a near-ubiquitous basis and contractually guaranteed coverage and performance. Spectrum would be expected to respond, and others might, as well. This approach would require a legal review and it appears that the City may need to own a portion of the assets in order to provide a cash incentive.

**3: City Expands Wireless Assets.** Under this scenario, the City would expand placement of poles and other assets for WISPs, and streamline permitting and other processes for underground fiber placement. However, by itself, this approach is unlikely to achieve much more than what the City is doing today. This approach might be more effective if done in conjunction with one of the

---

<sup>1</sup> The high cost to build is driven by last-mile costs. Many neighborhoods will require other funding sources (homeowners associations, residents, other) for last mile construction. The availability of middle-mile fiber does not address the high cost of last mile fiber.

previous two approaches, with the goal of reaching only the very hardest-to-reach areas and leveraging wired networks built with one of the other approaches.

These approaches come with advantages and disadvantages, which are discussed in Section 4 and summarized in Appendix B. A hybrid of the above three basic approaches may be needed.

We also note that while Ameren is not a provider, it could play a supporting role. Fiber on Ameren poles could potentially serve as one source for backhaul and bandwidth by connecting Wildwood back to a carrier hotel in St. Louis; some segments of fiber Ameren might be building could overlap with a middle-mile network; and Ameren could provide pole attachments for middle mile and last-mile fiber. These possibilities could be of some help and are described in Section 2.

CTC recommends that Wildwood engage in an RFP/RFI approach to solicit interest from ISPs for each approach and allow a range of ISPs to respond. It is expected that the various ISPs will have preferences in terms of the basic approach: cash incentive, middle-mile construction, or facilitation of wireless expansion. But only through an RFP process will Wildwood really be able to see what the providers will respond and what commitments they will make on either a middle-mile construction approach or a cash incentive approach. Before issuing an RFP and evaluating the responses, it would not be wise to try to negotiate an agreement in detail, given the many permutations in how Wildwood's broadband problems can be solved.

#### **1.4 Evaluation of Available City Infrastructure**

CTC evaluated the City's existing broadband infrastructure and the City's potential use of fiber for its own purposes to see whether it might achieve economies of scale through a buildout for two purposes (fiber for City needs and fiber for broadband service). The City has installed multiple poles to encourage wireless facilities. The City does not already have any fiber, and in terms of its own municipal needs, does not have multiple facilities or other significant drivers that would justify building middle-mile fiber for City purposes.

To date the City has built poles to support two WISPs in some areas of the western part of the City. But the local terrain, large lot sizes, spread-out development characteristics, and foliage have made it challenging, technically and economically, to provide widespread coverage. The City now recognizes that it needs to explore new approaches that go beyond such steps.

The City likely will not be eligible for federal grants and possibly state grants. The City's relatively high family income—and the fact that it is considered part of the St. Louis metropolitan area from the perspective of the federal government—make Wildwood ineligible for current federal programs (see Section 5.2). For example, current federal grant opportunities generally apply only to rural and unserved areas. As a result, any commitment of public funds will need to be City

funds. An RFP process will determine what kind of City investment will produce what response and commitment from private providers.

## 2 Engagement with Potential Partners

CTC engaged with private entities who could become potential partners to gauge their level of interest in participating in a solution. CTC held discussions with local ISPs and utility pole owners to explore joint opportunities and the shared benefits that might result.

### 2.1 Overview of Engagement

We gathered input on perceived demand, identified the WISPs' fiber backhaul needs in various parts of the City, and discuss potential partnership arrangements. We emphasize at the outset that the only way to fully understand the willingness of private providers to help solve the broadband problem in Wildwood is to issue an RFI/RFP, and then evaluate responses.

We contacted:

- Ameren
- Bays-ET
- Wisper ISP and
- Spectrum

The takeaways from these interactions can be summarized as follows: Ameren is not a broadband provider but does control assets that could play a role in an overall solution. Spectrum and Bayes are providers who potentially could be engaged, and have some ideas, but they generally favor different approaches. Spectrum favors a straight subsidy; Bayes would prefer City middle-mile, which again have respective advantages and disadvantages, as discussed in detail in Section 4. An RFP would be the way to get into these details and determine the magnitude of their willingness to participate and to understand the pros and cons. Procurement laws need to be followed, with all providers given equal treatment.

Bayes has been more active in terms of looking at a fiber solution. They have engaged in building fiber in two neighborhoods and is examining how to work with the City in moving forward. But as noted, without external funding Bayes cannot afford to address the issue on its own.

Already, with the help of the City in setting poles, wireless service from Bayes and Wisper are reaching some premises. And Bayes is engaged in building FTTP in two neighborhoods in the southwestern part of the City, where the geography and the economics made sense. These efforts are only in the construction stage, and even if these pilots succeed they will not suffice to solve the City's larger broadband challenges.

Bayes and Wisper are interested in expanding their business in Wildwood, but cannot make a business case for doing so, given the challenging geography and spread-out development

patterns. Wisper, which currently serves the northern part of the western half of the City, indicated that it would like to expand its wireless business if it were economically feasible to do so. The company does not have a strong interest in providing last-mile fiber service at this stage. Bayes currently serves the southern portion of the western half of the City with wireless service and is undertaking the FTTP pilots. It would be interested in fiber if the infrastructure costs were substantially borne by the City. As described later, these costs will be very high.

Spectrum indicated it would be interested in expanding service in Wildwood if the City provided a subsidy to Spectrum and Spectrum owned the resulting infrastructure. In 2011, Spectrum proposed expanding service if it got a \$1.9 million subsidy from the City. In our conversations, company representatives also stated that if Spectrum were to undertake design and cost estimation work on its side, it would want some assurances that the City was serious about this approach. The City would need to get a legal opinion on the feasibility of this approach, which would likely have to be implemented by issuing an RFP that included specifications, conditions and requirements.

## **2.2 The Role of Ameren**

Ameren, the electric utility, has expressed a willingness to work with Wildwood in a variety of potential roles; in all cases, Ameren<sup>2</sup> will need to strictly follow their internal policies and regulations set forth by the Missouri Public Service Commission (PSC).

- First, Ameren has existing fiber on transmission lines. But transmission routes do not permit mid-span splices or handholds, so these routes cannot be used for middle mile or last mile service. However, this fiber could potentially serve as one competitive source (there are others) for backhaul and bandwidth by connecting Wildwood back to a carrier hotel in St. Louis.
- Second, Ameren is considering installing more fiber to support distribution automation assets located on sub-transmission and distribution circuits. The potential exists that a few of the segments involved could overlap with a City middle mile network, and that Ameren could lease some strands of fiber to the City. However, these assets do not extend deeply into neighborhoods. The problem here is that there is no clear timetable on when Ameren might undertake construction of additional fiber. And Ameren understands that an AMI deployment will not drive a FTTP deployment.
- Third, Ameren could provide pole attachments for middle mile and last-mile fiber. However, the entity making the attachment would need to be a registered telecommunications carrier. The City is not a registered carrier. It could become one, but

---

<sup>2</sup> Ameren is regulated by the Missouri Public Utility Commission for rates, services, and other business activities.

will need to decide whether it wishes to do so. If the City decides against this, another entity would need to make these attachments. Bayes ET and Wisper are registered carriers.

- Ameren could prioritize upgrades in Wildwood as part of a 5-year plan to upgrade distribution system in portions of their service territory (this plan is still being formulated). This would potentially reduce make-ready costs.
- Ameren is looking at constructing utilities underground. In detailed design, we will need to understand where and when any underground construction will be occurring, as it may also force the City to install fiber underground.

We reiterate that a major consideration when working with Ameren is that it will need to strictly follow state PSC rules and rates, whether for leading or attachment fees. They are a investor owned utility and the City would need to follow their and PSC rules. They will not be able to provide help or subsidies for pole attachments or other work.

### 3 Conceptual Fiber Network Design and Cost Estimates

CTC prepared a high-level network design for the City's deployment of a gigabit-capable FTTP network to all homes and businesses in the City. Based on the high-level FTTP design, we developed three cost examples.

The first is the cost to deploy just the FTTP OSP infrastructure, which we refer to as a "dark FTTP" model. This is the total capital cost for the City to build a dark FTTP network for lease to a private partner. This dark FTTP model forms the basis for our FTTP financial analysis. The dark FTTP model is presented with two alternatives—one in which the cost for the fiber drop cable is the responsibility of the partner, and one in which the drop costs are the City's responsibility.<sup>3</sup>

The second estimate is the cost to deploy an FTTP infrastructure, all electronics, consumer drops, and customer premises equipment (CPE), which we refer to as a "lit" model. This estimate shows the *total capital costs*<sup>4</sup> (by the City or the City and partners) to build an FTTP network to support a ubiquitous Gigabit data service.

The third cost estimate is to deploy a backbone network to enable third party providers and wireless internet access providers to use the network to decrease costs for providing broadband services, particularly to the western part of the City.

The difference between these three cost estimates reflects the general range of costs that a private partner would incur to deploy FTTP within the City. Please note that the partner's costs (electronics) are subject to a seven- to 10-year replacement cycle, as compared to the 20- to 30-year lifespan of a City fiber investment.

The CTC cost estimate provides data relevant to assessing the financial viability of network deployment, and to developing a business model for a potential City construction effort (including the full range of models for public–private partnerships). This estimate also enables financial modeling to determine the approximate revenue levels necessary for the City to service any debt incurred in building the network.

In this section we present costs for:

- City deployed fiber backbone (middle-mile),
- Dark FTTP for the western portion of the City (low density),
- Dark FTTP for the entire City, and
- Lit model for the entire City

---

<sup>3</sup> A fiber drop cable connects the customer's premises to the distribution network.

<sup>4</sup> Capital costs are distinct from ongoing operations costs that the City or the City and partners will incur during ongoing maintenance and operation of the fiber enterprise.

The CTC design and cost estimate are underpinned by data and insight gathered by CTC engineers through discussions with City stakeholders, an extensive desk survey and on-site survey of candidate fiber routes, and a detailed sample design of the City.

Actual costs may vary due to factors that cannot be precisely known until the detailed design is completed, or until construction commences. These factors include:

1. Costs of private easements;
2. Utility pole replacement and make-ready costs;
3. Variations in labor and material costs;
4. Subsurface hard rock; and
5. The City's operational and business model.

We have incorporated suitable assumptions to address these items based on our experience in similar markets.

### **3.1 Survey Methodology for Developing Design and Cost Estimates**

To develop estimates of per-mile cost for aerial infrastructure in the communications space and per-mile costs for underground infrastructure where poles are not available, CTC engineers performed a survey of the City in person and via Google Earth Street View. The engineers reviewed available green space, necessary make-ready on poles, and pole replacement—all of which have been factored in to the design and cost estimate.

Table 2, below, summarizes the conditions determined through our field and desk survey.

**Table 2: Field Survey Findings**

Attribute	High Density	Medium Density	Low Density
Aerial Construction	35%	35%	35%
Poles per Mile	45	40	35
Moves per Pole	1.3	1.3	1.3
Poles Requiring Make-Ready	18%	18%	18%
Cost Per Move	\$350	\$350	\$350
Poles Requiring Replacement	8%	8%	8%
Average Pole Replacement Cost	\$7,000	\$7,000	\$7,000
Intermediate Rock	5%	5%	5%
Hard Rock	1%	1%	1%

CTC's OSP engineer noted that the quality of the poles and pole attachments in the City varied, as they do in many cities and counties—but that overall, most of the poles along the primary electrical distribution path would support an additional attachment. Within neighborhoods with

aerial utilities, the poles tend to be older and may not support additional attachments without upgrading the poles.

Figure 2, Figure 3, and Figure 4, below, show examples of poles in various conditions throughout Wildwood.

**Figure 2: Utility Pole Line Showing where Tree Trimming is Needed**



**Figure 3: Congested Pole where Make-Ready will be Required**



**Figure 4: Example of Low Make-Ready Pole Lines**



### **3.2 Fiber-to-the-Premises Network Design**

We developed a conceptual, high-level FTTP design that reflects the City's goals and is open to a variety of architecture options. The design assumes a combination of aerial and underground construction based on the placement of the existing utilities.

Figure 5, below, shows a logical representation of the high-level FTTP network architecture we recommend based on the conceptual design in this report. This design is open to a variety of architecture options.<sup>5</sup> 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 recommended architecture is a hierarchical data network that provides critical scalability and flexibility, both in terms of initial network deployment and its ability to accommodate the

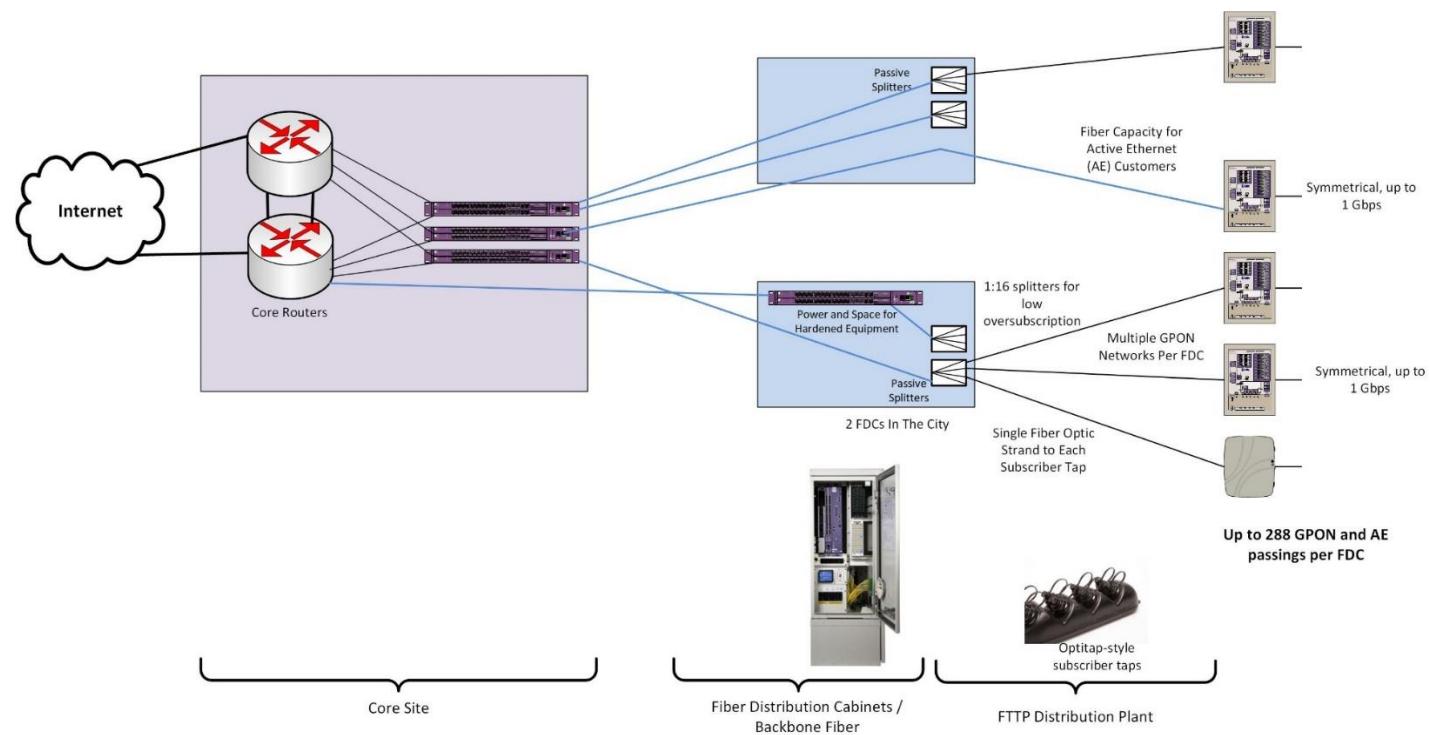
---

<sup>5</sup> The network's OSP is both the most expensive and the longest-lasting portion. The architecture of the physical plant determines the network's scalability for future uses and how the plant will need to be operated and maintained; the architecture is also the main determinant of the total cost of the deployment.

increased demands of future applications and technologies. The characteristics of this hierarchical FTTP data network are:

- **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
- **Failsafe operation** – 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 Virtual Local Area Network (VLAN) or Virtual Private Network (VPN) providing networks within the network)
- **Security** – controlled physical access to all equipment and facilities, plus network access control to devices

Figure 5: High-Level FTTP Architecture



This architecture offers scalability to meet long-term needs. It is consistent with best practices for an open-access network model that may be required to support multiple network operators, or at least multiple RSPs requiring dedicated connections to certain customers. This design would support a combination of Gigabit Passive Optical Network (GPON) and direct Active Ethernet (AE) 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 PROW or easements, providing watertight fiber connectors for customer service drop cables, and eliminating the need for service installers to perform splices in the field. This is an industry-standard approach to reducing both customer activation times and the potential for damage to distribution cables and splices. The model assumes the termination of standard lateral fiber connections within larger multi-tenant business locations and MDUs. The model also assumes that the City obtains easements or access rights to the gated communities and private drives within the communities to access the homes in those neighborhoods.

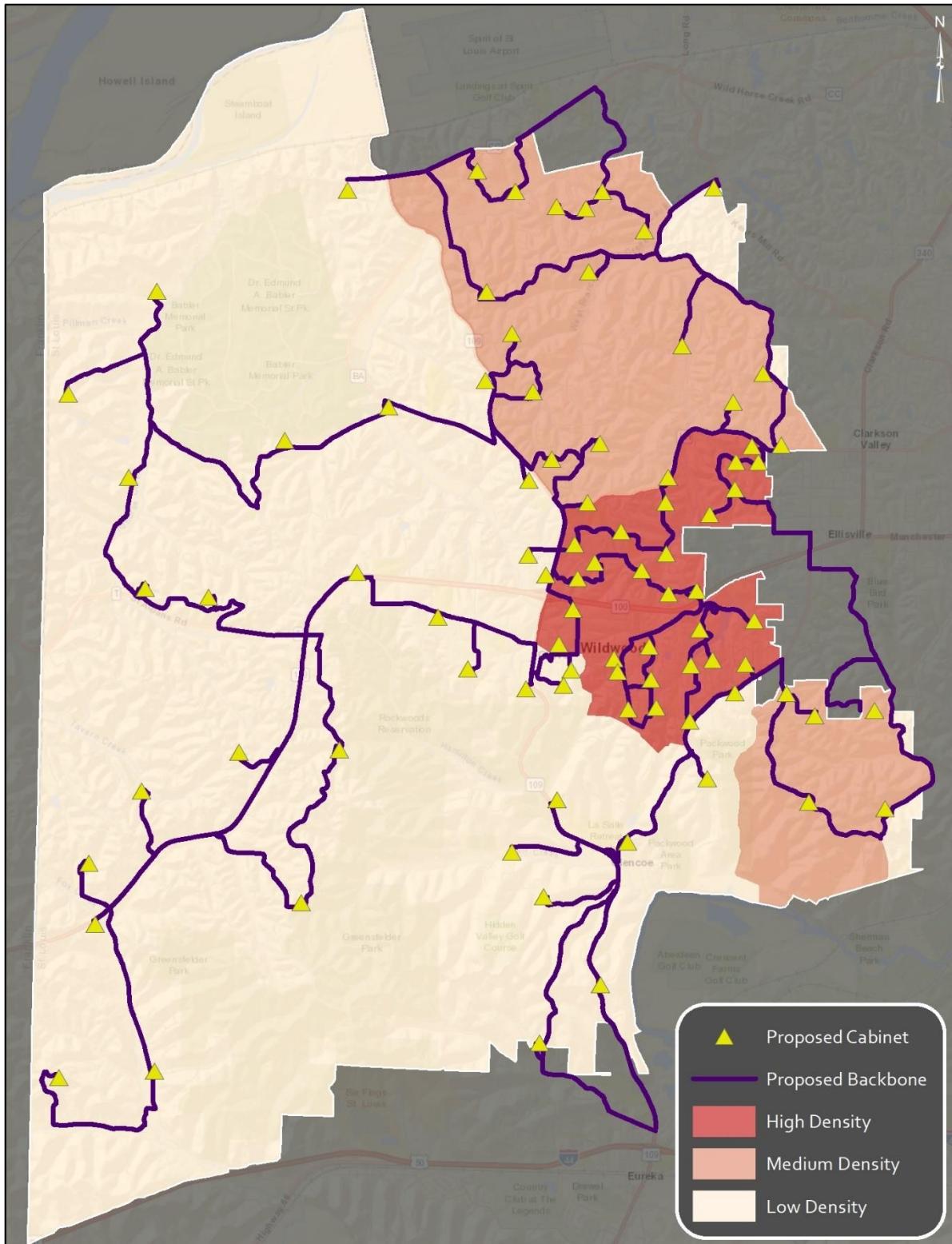
### 3.2.1 Network Design

The network design and cost estimates assume the City will:

- Use existing City land to locate a core and distribution hub facility. The cost estimate includes the facility costs with adequate environmental and backup power systems to house network electronics, and provide backhaul to the internet
- Construct a robust backbone network to connect to connect the distribution hub to the new fiber distribution cabinets (FDC)
- Construct fiber optics from the FDCs to each residence and business (i.e., from termination panels in the FDC to tap locations in the PROW or on City easements)
- Obtain easements or access rights to the gated communities and private roads where PROW do not exist; and
- Construct fiber laterals into large, multi-tenant business facilities and MDUs

Wildwood is unique in that the density varies from the denser eastern areas of the City to the low-density western areas. It is important to construct a robust backbone that can serve the needs of the future community. The backbone should provide redundancy where possible and extend to the outer edges of the City so that it will be near new subdivisions, which will enable service to be extended to these areas as they are built. Figure 6, below, shows an example backbone design for the City.

**Figure 6: FTTP Network Example Backbone (Middle-Mile) Design**



The backbone design could also be used to provide backhaul to wireless internet service providers who may be looking to deploy wireless where existing wireless service is inadequate or where FTTP services may not be cost effective

The FTTP network and service areas were defined based on the following criteria:

- Fiber will be installed in the communications space of utility poles where present, and in newly constructed conduit in underground areas
- Targeting up to 288 passings per FDC with 124 passings per FDC is the western part of the City
- The service area is the entire City
- Multiple FDCs per service area
- FDCs suitable to support hardened network electronics, providing backup power and an active heat exchange<sup>6</sup>
- Avoiding the need for distribution plant to cross major roadways and railways

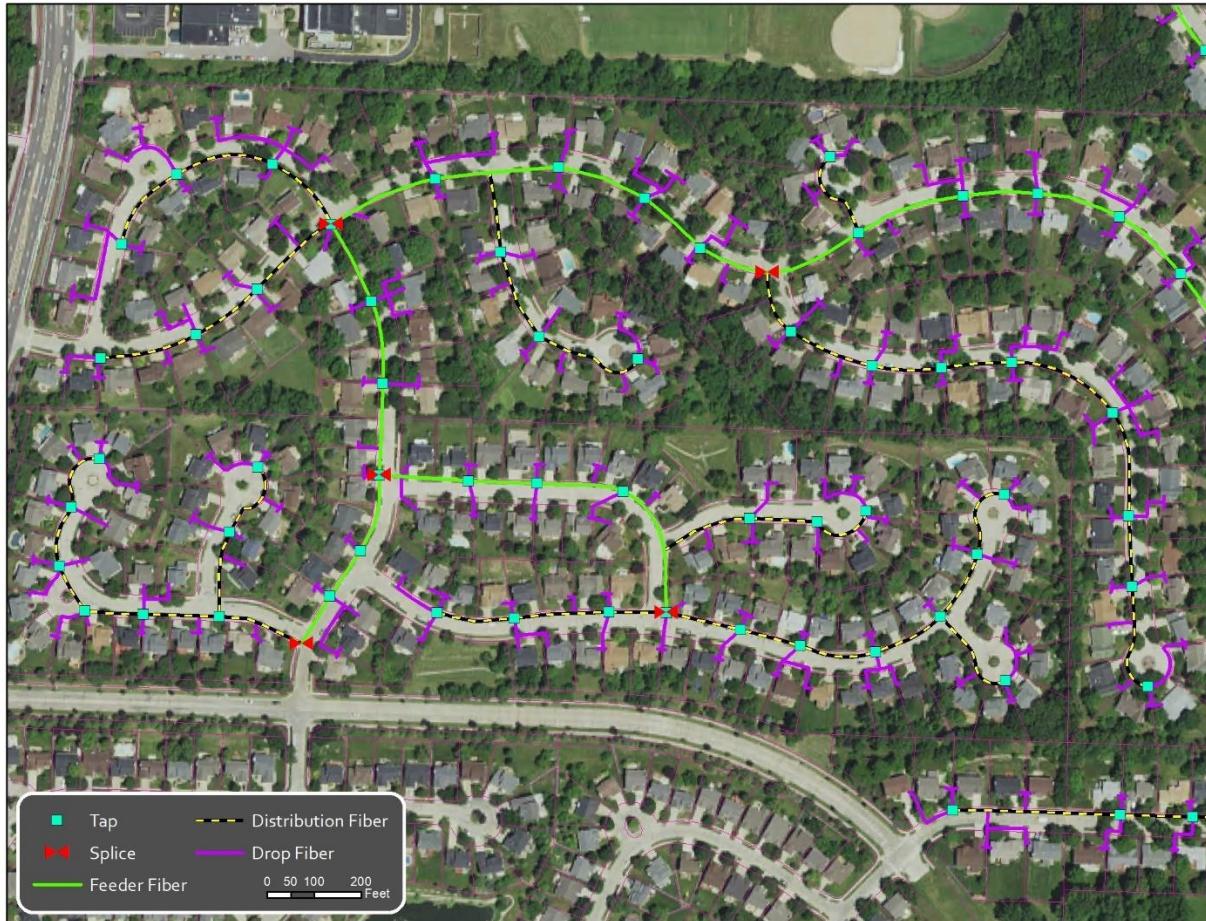
Coupled with an appropriate network electronics configuration, this design serves to greatly increase the reliability of fiber services provided to the customers compared to that of more traditional cable and telephone networks. The backbone and hub design minimizes the average length of non-diverse distribution plant between the network electronics and each customer, thereby reducing the probability of service outages caused by a fiber break.

The access layer of the network, encompassing the fiber plant from the FDCs to the customers, dedicates a single fiber strand from the FDC to each passing. This traditional FTTP design allows either network electronics or optical splitters in the FDCs. See Figure 7, below, for a sample design.

---

<sup>6</sup> These hardened FDCs reflect an assumption that the City's operational and business model will require the installation of provider electronics in the FDCs that are capable of supporting open access among multiple providers. We note that the overall FTTP cost estimate would decrease if the hardened FDCs were replaced with passive FDCs (which would house only optical splitters) and the providers' electronics were housed only at the hub facility.

**Figure 7: Sample FTTP Access Layer Design**



This architecture offers scalability to meet long-term needs and is consistent with best practices for an open access network model that may be required to support multiple network operators, or at least multiple RSPs requiring dedicated connections to certain customers.

### 3.2.2 Network Core and Hub Site

The core site is the bridge that links the FTTP network to the public internet and delivers all services to end users. The proposed network design includes a core location that shares space with the distribution and access electronics; however, if consumer demand dictates, a second internet point of presence (PoP) could be added to increase network redundancy or to decrease distances to customers.

For the cost estimate, we assumed that the core site electronics would be housed in a pre-fabricated telecommunications shelter located near the meet point with the ISP chosen to provide internet access for the FTTP network.

**Figure 8: Sample Hub Facility**



The core location in this plan will house providers' 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 PoP. This may be via remote connection, but collocation is recommended.

The core location is typically 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 core network locations are physically secure and allow 24x7x365 unencumbered access to authorized engineering and operational staff.

The operational environment of the network core and hub location is like that of a data center. This includes clean power sources, uninterruptable power supply (UPS) batteries, and diesel power generation for survival through sustained commercial outages. The facility must provide strong physical security, limited/controlled access, and environmental controls for humidity and temperature. Fire suppression is highly recommended.

Equipment is to be mounted securely in racks and cabinets, in compliance with national, state, and local codes. Equipment power requirements and specification may include -48-volt DC and/or 120/240 volts AC. All equipment is to be connected to conditioned / protected clean power with uninterrupted cutover to battery and generator.

For the cost estimate, we assumed that the core will be located on existing City land with adequate space for the shelter.

### **3.2.3 Distribution and Access Network Design**

The distribution network is the layer between the core hub and the FDCs, which provide the access links to the taps. The distribution network aggregates traffic from the FDCs to the core. Fiber cuts and equipment failures have progressively greater operational impact as they happen closer to the network core, so it is critical to build in redundancies and physical path diversities in the distribution network, and to seamlessly re-route traffic when necessary.

The distribution and access network design proposed in this report is flexible and scalable enough to support two different architectures:

1. Housing both the distribution and access network electronics at the hub, and using only passive devices (optical splitters and patches) at the FDCs
2. Housing the distribution network electronics at the hub and pushing the access network electronics further into the network by housing them at the FDCs

By housing all electronics at the hub, the network will not require power at the FDCs. Choosing a network design that only supports this architecture may reduce costs by allowing smaller, passive FDCs in the field. However, this architecture will limit the redundancy capability from the FDCs to the hubs.

By pushing the network electronics further into the field, the network gains added redundancy by allowing the access electronics to diversely connect to the hub. In the event of a fiber outage on one link, the subscribers connected to the FDC would still have network access.

A design that supports both models would allow the City to accommodate many different service operators and their network designs. This design would also allow service providers to start with a small deployment (i.e., place electronics only at the hub site, and grow by pushing electronics closer to their subscribers).

#### ***3.2.3.1 Access Network Technologies***

FDCs can sit on a curb, be mounted on a pole, or reside in a building. The model recommends installing sufficient FDCs to support higher-than-anticipated levels of subscriber penetration. This approach will accommodate future subscriber growth with minimal re-engineering. Passive optical splitters are modular and 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.

**Figure 9: Fiber Distribution Cabinet**



The FTTP design also includes the placement of indoor FDCs and splitters to support MDUs. This would require obtaining the right to access the equipment for repairs and installation in whatever timeframe is required by the service agreements with the customers. Lack of access would potentially limit the ability to perform repairs after normal business hours, which could be problematic for both commercial and residential services.

In this model, we assume the use of GPON electronics for most subscribers and AE for a very small percentage of subscribers (typically high-end business customers) that request a premium service or require greater bandwidth. GPON is the most commonly provisioned FTTP service—used, for example, by AT&T Fiber, Verizon (in its FiOS systems), Google Fiber, and Chattanooga EPB.

Further, providers of gigabit services typically provide these services on GPON platforms. Even though the GPON platform is limited to 1.2 Gigabits per second (Gbps) upstream and 2.4 Gbps downstream for the subscribers connected to a single PON, operators have found that the variations in actual subscriber usage generally means that all subscribers can obtain 1 Gbps on demand (without provisioned rate-limiting), even if the capacity is aggregated at the PON. Further, many GPON manufacturers have a development roadmap to 10 Gbps and faster speeds as user demand increases.

GPON supports high-speed broadband data, and is easily leveraged by triple-play carriers for voice, video, and data services. The GPON optical line terminal (OLT) uses single-fiber (bi-directional) Small Form-factor Pluggable (SFP) modules to support multiple (most commonly less than 32) subscribers.

GPON uses passive optical splitting, which is performed inside the FDC, to connect fiber from the OLTs to the customer premises. The FDCs house multiple optical splitters, each of which splits the fiber link to the OLT between 16 to 32 customers (in the case of GPON service).

AE provides a symmetrical (up/down) service that is commonly referred to as Symmetrical Gigabit Ethernet. AE can be provisioned to run at sub-gigabit speeds, and—like GPON—easily supports legacy voice, Voice over Internet Protocol (VoIP), and video. AE is typically deployed for customers who require specific service level agreements that are easier to manage and maintain on a dedicated service.

For subscribers receiving AE service, a single dedicated fiber goes directly to the subscriber premises with no splitting. Because AE requires dedicated fiber (also known as “home-run fiber”) from the OLT to the CPE, and because each subscriber uses a dedicated SFP on the OLT, there is a significant cost difference in provisioning an AE subscriber versus a GPON subscriber.

The fiber plant is designed to provide AE service or PON service to all passings. The network operator selects electronics based on the mix of services it plans to offer and can modify or upgrade electronics to change the mix of services.

### ***3.2.3.2 Expanding the Access Network Bandwidth***

GPON is currently the most commonly provisioned FTTP technology, due to inherent economies when compared with technologies delivered over home-run fiber,<sup>7</sup> such as AE. Based on our experience, the cost differential between constructing an entire network using GPON and AE is 40 percent to 50 percent. GPON is used to provide services up to 1 Gbps per subscriber and is part of an evolution path to higher-speed technologies that use higher-speed optics and wave-division multiplexing (WDM).

This model provides many options for scaling capacity, which can be done separately or in parallel:

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 can be accomplished by adding electronics at the FDC or hub locations; since these use different frequencies than the GPON electronics, none of the other CPE would need to be replaced.

---

<sup>7</sup> Home-run fiber is a fiber optic architecture in which individual fiber strands are extended from the distribution sites to the premises. Home-run fiber does not use any intermediary aggregation points in the field.

3. Adding WDM-PON electronics as they become widely available, which 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.
4. Option 1 could be taken to the maximum, and PON replaced by a 1:1 connection to electronics—an AE configuration.

These upgrades would all require complementary upgrades in the backbone and distribution Ethernet electronics, as well as in the upstream internet connections and peering—but they would not require increased fiber construction.

#### ***3.2.3.3 Customer Premises Equipment and Subscriber Services***

In the final segment of the FTTP network, fiber runs from the FDC to customers' homes, apartments, and office buildings, where it terminates at the subscriber tap—a fiber optic housing located in the PROW closest to the premises. The service installer uses a pre-connectorized drop cable to connect the tap to the subscriber premises without the need for fiber optic splicing.

The drop cable extends from the subscriber tap (either on the pole or underground) to the building, enters the building, and connects to CPE.

### **3.3 Dark Fiber-to-the-Premises Cost Estimate**

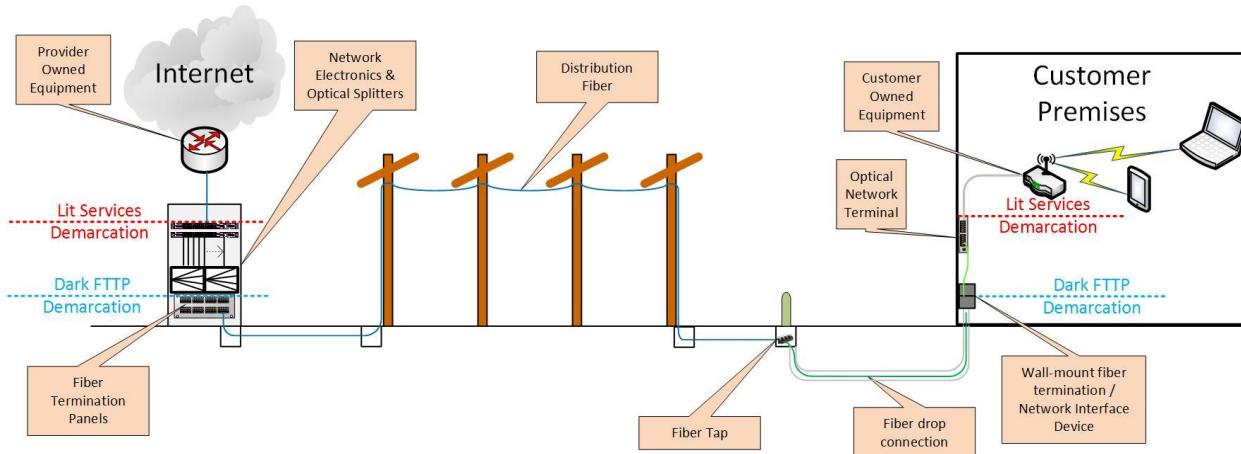
A dark FTTP network deployment will cost approximately \$69 million, inclusive of OSP construction labor, materials, engineering, permitting, lateral drops, and drop materials. This estimate assumes a 35 percent take rate. This estimate does not include any electronics or subscriber equipment.

**Table 3: Estimated Dark FTTP Cost with Drops (Assuming a 35 Percent Take Rate)**

Cost Component	Total Estimated Cost
OSP	\$49.0 million
FTTP Service Drop and Lateral Installations	10.0 million
<b>Total Estimated Cost:</b>	<b>\$59.0 million</b>

This estimate assumes that the City constructs and owns the FTTP infrastructure up to a demarcation point (a network interface device) at each residence and business, and leases the dark fiber backbone, distribution, and drop fiber to a private partner. The private partner would be responsible for all network electronics and CPE—as well as network sales, marketing, and operations.

**Figure 10: Demarcation Between City and Partner Network Elements in the Lit and Dark Models**



### 3.4 Lit Fiber-to-the-Premises Cost Estimate

Assuming a take rate (i.e., the percentage of residents and businesses that subscribe to the service) of 35 percent, the full FTTP network deployment will cost more than \$64.2 million, inclusive of OSP construction labor, materials, engineering, permitting, network electronics, drop installation, CPE, and testing.

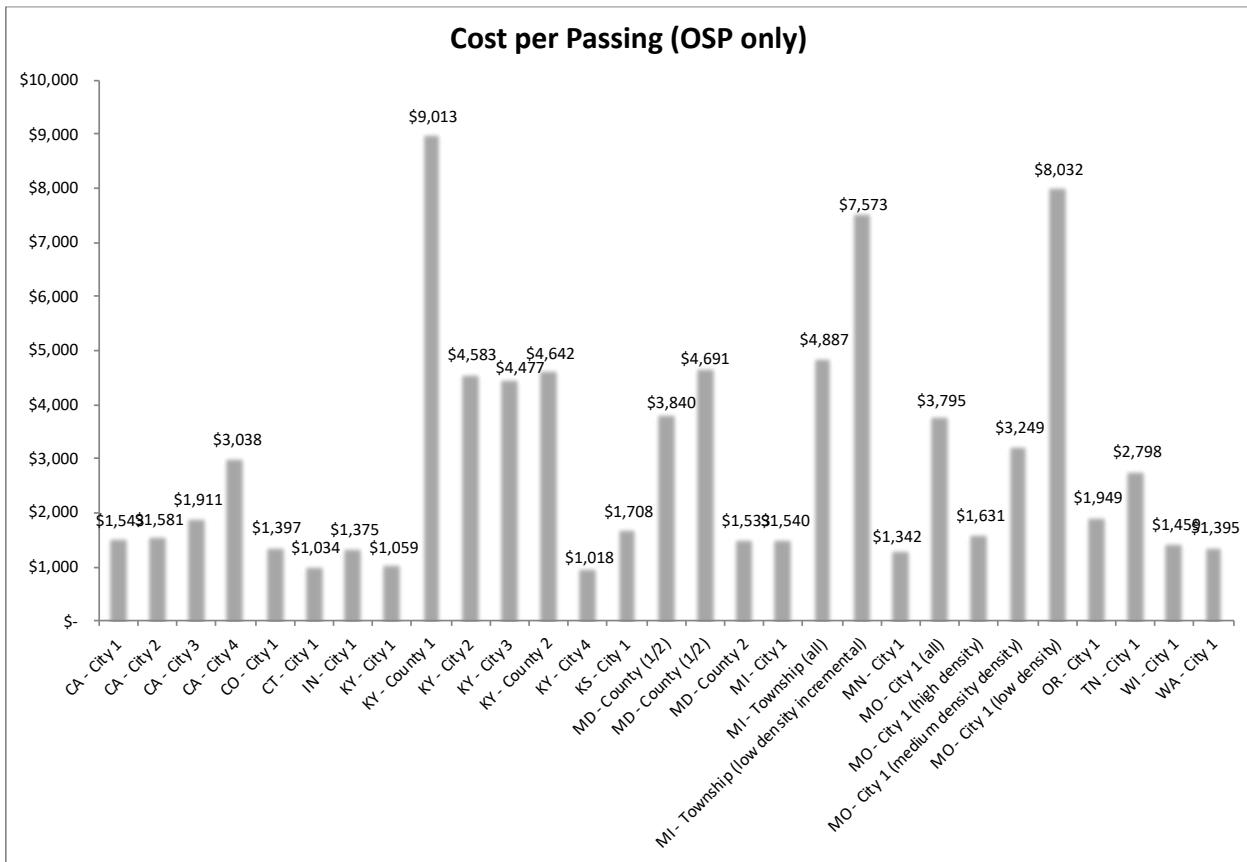
**Table 4: Estimated Lit FTTP Cost**

Cost Component	Total Estimated Cost
OSP	\$49.0 million
Central Network Electronics	2.3 million
FTTP Service Drop and Lateral Installations	10.0 million
CPE	2.9 million
<b>Total Estimated Cost:</b>	<b>\$64.2 million</b>

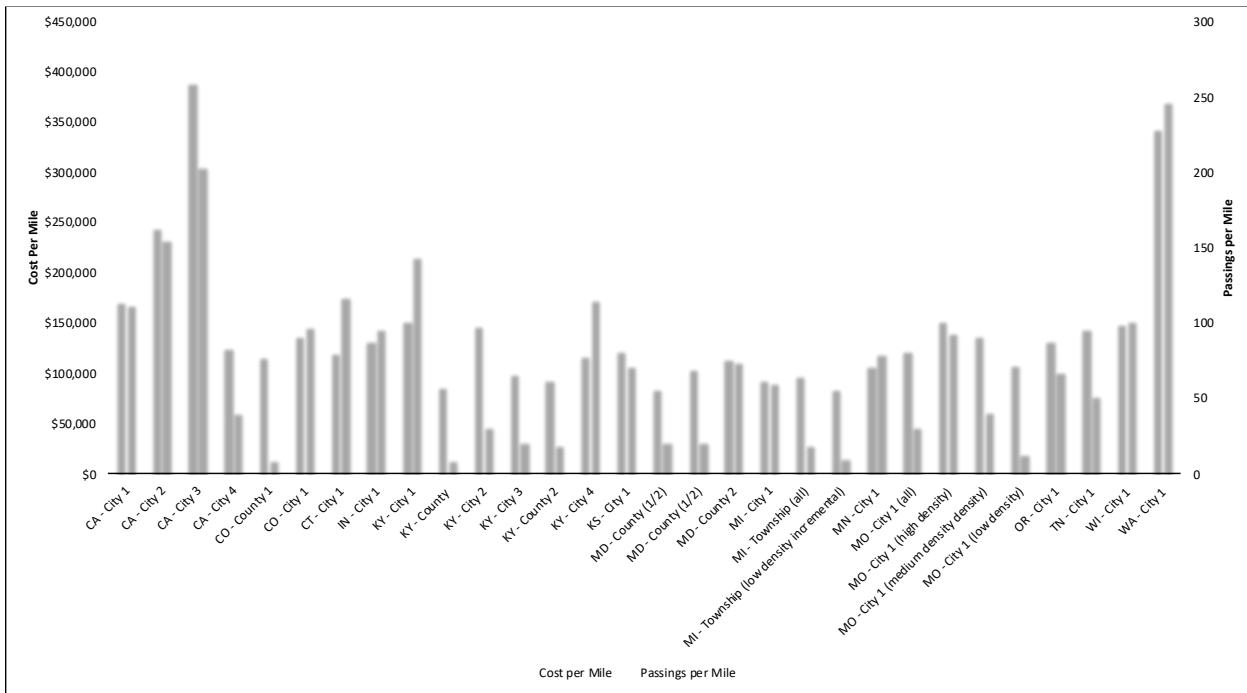
#### 3.4.1 Cost per Passing

On a per-passing basis, the lit FTTP deployment will cost \$3,800 on average. The \$3,800 per passing cost for the City of Wildwood is similar to other communities we have worked with that contain a high percentage of underground infrastructure with relatively low density housing. Figure 11 and Figure 12, below, show the potential range of costs for a variety of communities with which CTC has been engaged. Please note that the City of Wildwood is “MO - City 1” in the figures below. Further the per passing costs for the high, medium, and low densities split the backbone costs evenly between them.

**Figure 11: FTTP Cost per Passing Comparison**



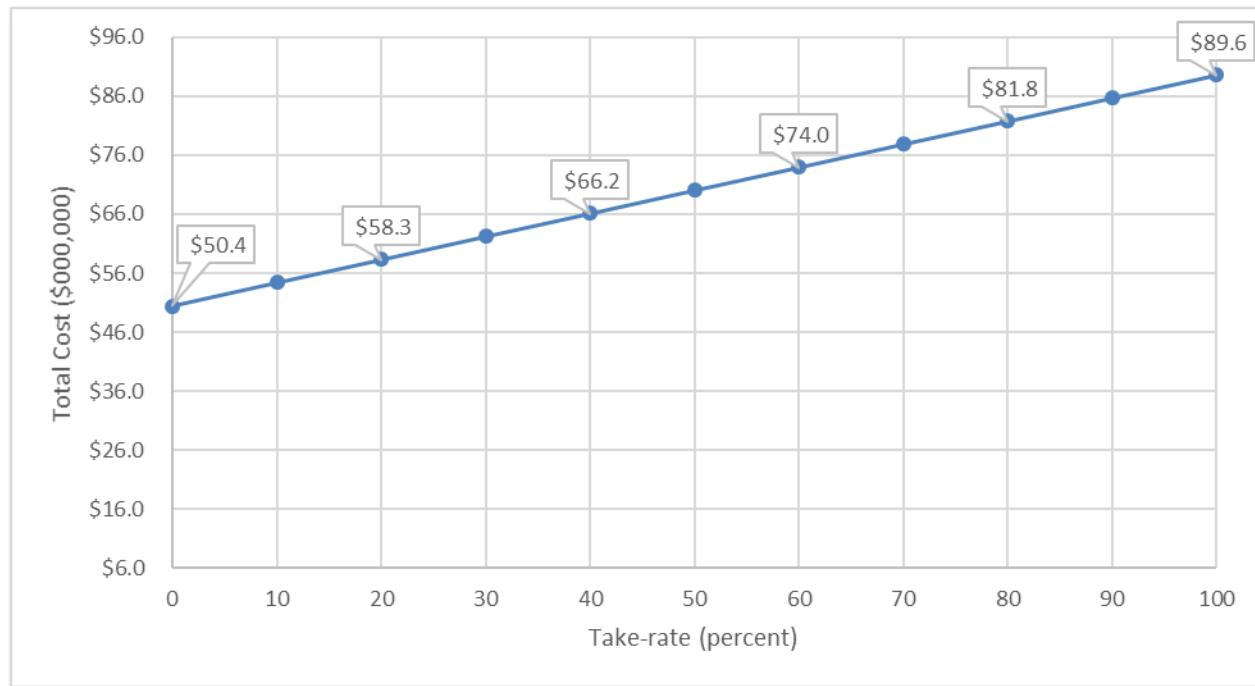
**Figure 12: FTTP Key Cost Factors (Density and Construction Cost)**



As indicated above, the take rate is the percentage of homes/businesses passed with fiber that will acquire service from the FTTP provider. The estimated 35 percent take rate is within the range that may exist in a market where both the cable and telephone companies also provide broadband service.

Figure 13 shows the total estimated cost by varying the expected take rate. Table 4 assumes a take rate of 35 percent.

**Figure 13: Total Estimated Cost versus Take Rate**



The cost is roughly linear by take rate, as the cost of adding additional subscribers is a fixed cost.

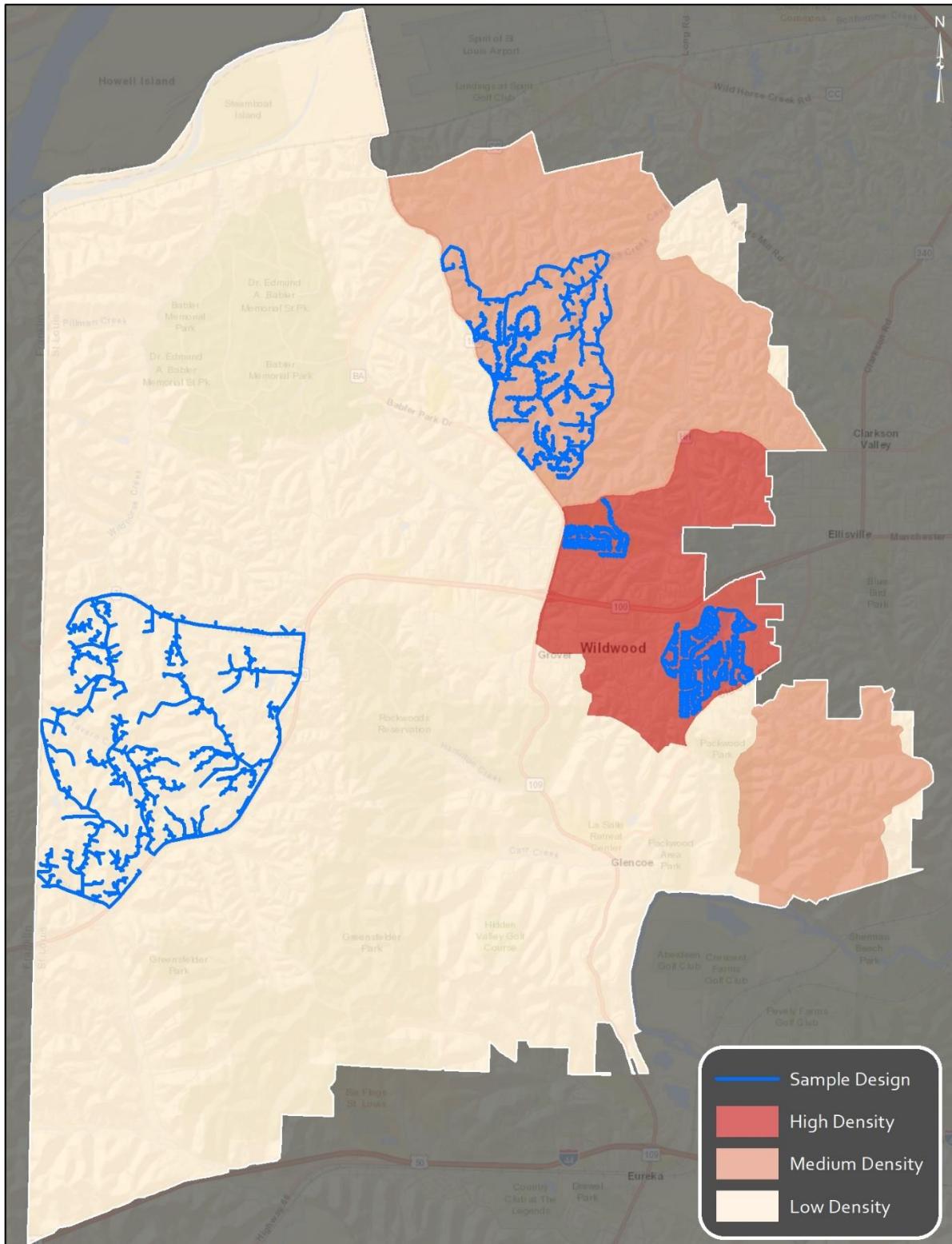
The total cost of operations will also vary with the business model chosen and the level of existing resources that can be leveraged by the City and any potential business partners.

### 3.4.2 OSP Cost Estimation Methodology

As with any utility, the design and associated costs for construction vary with the unique physical layout of the service area—no two streets are likely to have the exact same configuration of fiber optic cables, communications conduit, underground vaults, and utility pole attachments. Costs are further varied by soil conditions, such as the prevalence of subsurface hard rock; the condition of utility poles and feasibility of “aerial” construction involving the attachment of fiber infrastructure to utility poles; and crossings of bridges, railways, and highways.

To estimate costs, we extrapolated the costs for strategically selected sample designs based on street mileage and passings. Given the size of the City, we were able to develop an extensive sample design.

**Figure 14: Map of the Sample Design**



Our observations determined that the utilities are primarily aerial in the older portions of the City, and that newer developments are completely underground. We also anticipate that any new subdivisions will likely be constructed underground.

The assumptions, sample designs, and cost estimates were used to extrapolate a cost-per-passing for the OSP infrastructure. This number was then multiplied by the number of passings in each area based on the City's estimation of the population.

The actual cost to construct FTTP to every premises in the City could differ from the estimate due to changes in the assumptions underlying the model. For example, if make-ready and pole replacement costs are too high, the network would have to be constructed underground—which could significantly increase the cost of construction. Alternatively, if the City could partner with a local telecommunications provider and overshadow to existing pole attachments, the cost of the build could be significantly lower. Further and more extensive analysis would be required to develop a more accurate cost estimate across the entire City.

### **3.4.3 OSP Costs**

The estimated cost to construct the OSP portion of the proposed FTTP network is approximately \$49.0 million, or \$3,800 per passing.<sup>8</sup> As discussed above, the model assumes a mixture of aerial and underground fiber construction, depending on the construction of existing utilities in the area as well as the state of any utility poles, existing infrastructure, and construction within the communication space. Table 5 provides a breakdown of the estimated OSP costs. (Note that the costs have been rounded.)

---

<sup>8</sup> The passing count includes individual single-unit buildings and units in small multi-dwelling and multi-business buildings as single passings. It treats larger buildings as single passings.

**Table 5: Estimated OSP Costs**

Phase	Distribution Plant Mileage	Total Cost	Passings	Cost per Passing	Cost Per Plant Mile
Total	<b>403.0</b>	<b>\$49,040,000</b>	<b>12,920</b>	<b>\$3,800</b>	<b>\$120,000</b>
High Density	63.0	\$8,190,000	5,900	\$1,390	\$131,000
Medium Density	84.0	\$10,077,000	3,540	\$2,840	\$120,000
Low Density	256.0	\$26,458,000	3,470	\$7,620	\$103,000
Backbone	-	\$4,315,000	-	N/A	N/A

### **3.4.3.1 Aerial and Underground Construction Approach**

Costs for aerial and underground placement were estimated using available unit cost data for materials and estimates on the labor costs for placing, pulling, and boring fiber based on construction in comparable markets. The material costs were generally known, with the exception of unknown economies of scale and inflation rates, and barring any sort of phenomenon restricting material availability and costs. The labor costs associated with the placement of fiber were estimated based on similar construction projects.

Aerial construction entails the attachment of fiber infrastructure to existing utility poles, which could offer significant savings compared to all-underground construction, but increases uncertainty around cost and timeline. Costs related to pole remediation and make-ready construction can make aerial construction cost-prohibitive in comparison to underground construction.

We assume the installation of strand that the fiber will be lashed to in the communications space on the existing utility poles. Splice cases, subscriber taps, and drops will also be attached to the strand, which facilitates maintenance and customer installation.

While generally allowing for greater control over timelines and more predictable costs, underground construction is subject to uncertainty related to congestion of utilities in the PROW and the prevalence of subsurface hard rock—neither of which can be fully mitigated without physical excavation and/or testing.

While anomalies and unique challenges will arise regardless of the design or construction methodology, the relatively large scale of this project is likely to provide ample opportunity for variations in construction difficulty to yield relatively predictable results on average.

We assume underground construction will consist primarily of horizontal, directional drilling to minimize PROW impact and to provide greater flexibility to navigate around other utilities. The design model assumes a single 2-inch, flexible, High-Density Polyethylene (HDPE) conduit over underground distribution paths, and dual 2-inch conduits over underground backbone paths to provide scalability for future network growth.

### ***3.4.3.2 OSP Cost Components***

The cost components for OSP construction include the following tasks:

- ***Engineering*** – includes system level architecture planning, preliminary designs and field walk-outs to determine candidate fiber routing; development of detailed engineering prints and preparation of permit applications; and post-construction “as-built” revisions to engineering design materials.
- ***Quality Control / Quality Assurance*** – includes expert quality assurance field review of final construction for acceptance.
- ***General OSP Construction*** – consists of all labor and materials related to “typical” underground or aerial OSP construction, including conduit placement, utility pole make-ready construction, aerial strand installation, fiber installation, and surface restoration; includes all work area protection and traffic control measures inherent to all roadway construction activities.
- ***Special Crossings*** – consists of specialized engineering, permitting, and incremental construction (material and labor) costs associated with crossings of railroads, bridges, and interstate / controlled access highways.
- ***Backbone and Distribution Plant Splicing*** – includes all labor related to fiber splicing of outdoor fiber optic cables.
- ***Backbone Hub, Termination, and Testing*** – consists of the material and labor costs of placing hub shelters and enclosures, terminating backbone fiber cables within the hubs, and testing backbone cables.
- ***FTTP Service Drop and Lateral Installations*** – consists of all costs related to fiber service drop installation, including OSP construction on private property, building penetration, and inside plant construction to a typical backbone network service “demarcation” point; also includes all materials and labor related to the termination of fiber cables at the

demarcation point. A take-rate of 35 percent was assumed for standard fiber service drops.

### 3.4.4 Central Network Electronics Costs

Central network electronics will cost an estimated \$2.3 million, or \$175 per passing, based on an assumed take-rate of 35 percent.<sup>9</sup> (These costs may increase or decrease depending on take rate, and the costs may be phased in as subscribers are added to the network.) The central network electronics consist of the electronics to connect subscribers to the FTTP network at the core and cabinets. Table 6, below, lists the estimated costs for each segment.

**Table 6: Estimated Central Network Electronics Costs**

Network Segment	Subtotal	Passings	Cost per Passing
Core and Distribution Electronics (Sections 3.4.4.1 and 3.4.4.2)	\$1.3 million	12,920	\$100
FTTP Access Electronics (Section 3.4.4.1)	\$1.0 million	12,920	\$75
<b>Central Network Electronics Total</b>	<b>\$2.3 million</b>	<b>12,920</b>	<b>\$200</b>

#### 3.4.4.1 Core Electronics

The core electronics connect the distribution electronics and connect the network to the internet. The core electronics consist of high performance routers, which handle all the routing on both the FTTP network and to the internet. The core routers should have modular chassis to provide high availability in terms of redundant components and the ability to “hot swap” line cards and modular in the event of an outage.<sup>10</sup> Modular routers also provide the ability to expand the routers as demand for additional bandwidth increases.

The cost estimate design envisions running networking protocols, such as hot standby routing protocol (HSRP), to ensure redundancy in the event of a router failure. Additional connections can be added as network bandwidth on the network increases. The core sites would also tie to the distribution electronics using 10 Gbps links. The links to the distribution electronics can also be increased with additional 10 Gbps and 40 Gbps line cards and optics as demand grows on the network. The core networks will also have 10 Gbps to ISPs that connect the FTTP network to the internet.

---

<sup>9</sup> The take rate affects the electronics and drop costs, but also may affect other parts of the network, as the City may make different design choices based on the expected take rate. A 35 percent take rate is typical of environments where a new provider joins the telephone and cable provider in a City. In CTC’s financial analysis, we will examine how the feasibility of the project depends on a range of take rates.

<sup>10</sup> A “hot swappable” line card can be removed and reinserted without the entire device being powered down or rebooted. The control cards in the router should maintain all configurations and push them to a replaced line card without the need for reconfirmation.

The cost of the core routing equipment is \$500,000. These costs do not include the service provider's OSS, such as provisioning platforms, fault and performance management systems, remote access, and other operational support systems for FTTP operations. The service providers may already have these systems in place.

#### ***3.4.4.2 Distribution Electronics***

The distribution network electronics aggregate the traffic from the FDCs and send it to the core electronics to access the internet. The distribution electronics consist of high-performance aggregation switches, which consolidate the traffic from the many access electronics and send it to the core for route processing. The distribution switches are typically modular switch chassis that can accommodate line cards for aggregation. The switches should also be modular to provide redundancy in the same manner as the core switches.

The cost estimate assumes that the aggregation switches connect to the access network electronics with 10 Gbps links to each distribution switch. The aggregation switches would then connect to the core switches over single or multiple 10 Gbps links as needed to meet the demand of the FTTP users in each service area.

The cost of the distribution switching equipment is \$500,000. These costs do not include any of the service provider's OSS or other management equipment.

#### ***3.4.4.3 Access Electronics***

The access network electronics at the FDCs connect the subscribers' CPE to the FTTP network. We recommend deploying access network electronics that can support both GPON and AE subscribers to provide flexibility within the FDC service area. We also recommend deploying modular access network electronics for reliability and the ability to add line cards as more subscribers join in the service area. Modularity also helps reduce initial capital costs while the network is under construction or during the roll out of the network.

The cost of the access network electronics for the network is estimated at approximately \$1.3 million. These costs are based on a take rate of 35 percent and include optical splitters at the FDCs for that take-rate.

### ***3.4.5 Customer Premises Equipment and Service Drop Installation (Per Subscriber Costs)***

CPE is the subscriber's interface to the FTTP network. For this cost estimate, we selected CPE that provide only Ethernet data services (however, there are a wide variety of CPE offering other data, voice, and video services). Using the assumed take rate of 35 percent, we estimated the cost for subscriber CPE will be approximately \$2.9 million.

Each activated subscriber would also require a fiber drop cable installation and related electronics, which would cost roughly \$2,850 per subscriber, or \$12.9 million total—again, assuming a 35 percent take rate.

The drop installation cost is the biggest variable in the total cost of adding a subscriber. A short aerial drop can cost as little as \$250 to install, whereas a long underground drop installation can cost upward of \$5,000. We estimate an average of \$2,220 per drop installation.

The other per-subscriber expenses include the cost of the optical network terminal (ONT) at the premises, a portion of the OLT costs at the hub, the labor to install and configure the electronics, and the incidental materials needed to perform the installation. The numbers provided in Table 7, below, are averages and will vary depending on the type of premises and the internal wiring available at each premises.

**Table 7: Per Subscriber Cost Estimates**

<b>Construction and Electronics Required to Activate a Subscriber</b>	<b>Estimated Average Cost</b>
Drop Installation and Materials	\$2,220
Subscriber Electronics (ONT and OLT)	330
Electronics Installation	200
Installation Materials	100
<b>Total</b>	<b>\$2,850</b>

### 3.4.1 Cost Estimate Assumptions

In developing the OSP cost estimate, unit cost estimates were created based on the existing construction conditions, labor market, current material costs, and project scope. Table 8 outlines the cost estimate assumptions that were used to generate the range of cost estimates. Additional details can be located in the attached cost estimate spreadsheet (Appendix E).

**Table 8: Cost Estimate Assumptions**

<b>Description</b>	<b>Unit</b>	<b>Assumption</b>
Total average cost per mile (Distribution Only)	\$/mi	\$120,000
Placement of 2-inch conduit using directional boring	\$/ft	\$11.00
Pull-box placement, 24"x36"x36" Tier 22	EA	\$1,050
Aerial cable installation per foot	\$/ft	\$2.00
Traffic control and work area protection per foot	\$/ft	\$1.00
Tree Trimming	\$/ft	\$0.50
Make-ready per foot	\$/ft	\$8.66 to \$11.05
288-count cable	\$/ft	\$2.05
Miscellaneous installation hardware	\$/ft	\$0.90

Appendix E is attached as a Microsoft Excel spreadsheet.

## 4 Approaches and Business Models

As part of its analysis CTC summarized the City's options for implementing the design described above. The City's options can be summarized in three basic approaches.

### 4.1 Overview of Models

The first approach involves the City building a FTTP network. (This network could be operated under one of four models, in decreasing order of complexity for the City: a full retail model, an open-access model, a privately-run open-access model, and a dark fiber model.)

The second approach involves the City building only a “middle-mile” network along main roads or other corridors and working with private providers and homeowners to create financing and business models for constructing the last-mile portion to premises.

The third approach involves the City providing incentives to private parties in exchange for those parties providing agreed-upon service coverage and perhaps fiber strands for City use. (Incentive approaches range from issuing an RFP offering incentives, to which Spectrum and perhaps others would be expected to respond, to expanding the placement of poles to aid the wireless ISPs operating in Wildwood. The FTTP approaches are presented in

Table 9; the middle-mile and incentive approaches are summarized in Table 10.

**Table 9: FTTP Approaches**

FTTP Approach	Capital Expense	Impact on Broadband Availability	Likelihood Financial Success	Likelihood of Meeting Service Goals
<b>A: City Offers Retail Services</b> In addition to the FTTP network, the City owns and operates the network electronics and runs a business providing retail services	\$64.2 million citywide (or \$31.4 million for low-density areas), at a 35 percent take-rate including drop costs	High	Low	High
<b>B: City Enables Open Access</b> Same as A, except the City does not provide retail services; rather, it enables open-access services to approved ISPs	\$64.4 million citywide (or \$31.6 million for low-density areas), at a 35 percent take-rate including drop costs (includes addition of management software)	High	Low	Moderate
<b>C: City Enables Private Open Access Provider</b> Same as B, except that a third-party owns and operates the electronics and enables open-access services to ISPs	\$49.0 million citywide (\$30.8 million, low-density only) assuming City does not pay drop costs	High	Low	Moderate
<b>D: City Leases Dark FTTP</b> The City only leases the dark FTTP to a private provider who owns and operates all electronics and provides retail service	\$49.0 million citywide (\$30.8 million, low-density only) assuming City does not pay drop costs	High	Low	Moderate

The middle-mile and incentive options are summarized in Table 10.

**Table 10: Middle-Mile and Incentive Approaches**

Approach		Capital Expense	Impact on Broadband Availability	Likelihood of Financial Success	Likelihood of Meeting Service Goals
Middle-Mile Fiber	<b>E. City Leases Dark Middle Mile</b> City provides access to middle-mile fiber to third parties. The third parties own and operate last mile infrastructure—OSP and electronics—and provide retail services	\$4.3 million	Low to Moderate	Low to Moderate	Low to Moderate
Incentives	<b>F: City Offers Cash Incentives</b> The City issues an RFP offering funds for any ISP willing to provide coverage guarantees with broadband service. Spectrum would be expected to respond, others might	\$2.5 million to \$3.5 million (estimate based on discussions with Spectrum)	Moderate to High	Moderate	Moderate
	<b>G. Expand Wireless Assets</b> The City expands placement of poles and other assets for WISPs and streamlines permitting and other processes for underground fiber placement	TBD, but minimal	Low	High	Low
	<b>H: Continue on Same Path</b> The City supports pole additions as requested and streamlines permitting and other processes for underground fiber placement	TBD, but minimal	Low	High	Low

## 4.2 Advantages and Disadvantages of the Models

In consultation with the City we have determined that three of these (items E, F, and G above) are the most feasible: the City build and leases a dark fiber middle-mile network; the City provides cash incentives; or the City expands wireless assets. The advantages and disadvantages of these three approaches is summarized below; as noted earlier, a combination of all three of these approaches may ultimately be required. A table outlining advantages and disadvantages of all eight approaches is provided as Appendix B.

**1: Middle Mile Option:** Under the model in which the City owns and operates fiber middle-mile (and a third party owns and operates last mile infrastructure and provides services), the advantages are that it requires a much smaller City investment than building a full FTTP network, the City does not have to provide service, and the City would own the middle-mile infrastructure.

But the disadvantages are that the providers' payment to access the dark middle mile fiber is unlikely to cover cost of debt service and operating costs of the middle mile fiber. The model may not attract ISPs, at least not everywhere in the City. And ISPs are likely to build only in selected neighborhoods (and not provide ubiquitous coverage), given the high cost of deploying FTTP in the western portions of the City. Finally, homeowner contributions would still be required. The City would also need to register with the Missouri Public Service Commission.

**2: Cash Incentive Option:** Under the option where the City provides cash incentives, the advantages are that it might be a relatively low cost compared to the middle-mile option, may meet core objectives, and the City would not need to provide retail service. The disadvantages are the potential legal restrictions; the City would need to consult with an attorney on whether the City could contribute but not own the asset. The City would then be reliant on the ISP to follow through on when and where to build, though contract terms could reduce this disadvantage. And finally, there would be no direct recovery of the investment. We note that Spectrum (formerly Charter) provided a proposal to Wildwood based on this approach in 2011.

**3: Expand Wireless Assets Option:** Under the option in which the City expands its placement of poles and other assets for WISPs and seeks to streamline permitting and other processes for underground fiber placement, the advantages are that it minimizes City's financial requirements and the City would not have to provide retail services. However, the disadvantages are that it would have only a minimal impact on the availability of broadband in the western portion of the City and would be very unlikely to meet all availability and performance objectives.

## 5 Funding and Financing Strategies

A key consideration for any broadband network deployment is how to finance upfront capital construction costs. These costs represent a large expenditure that is generally slow to yield a return; the lack of a quick return on investment (ROI) sheds some light on why the private sector is not clamoring to upgrade existing legacy networks with fiber infrastructure, or to build new FTTP networks, in many parts of the country.

### 5.1 Options for Bonds and Other Loans

The City can seek bonding, or borrow funds, to cover construction costs both to construct a network and in consideration of likely operations and maintenance (O&M) costs. Public bonds may also factor into a public–private partnership; that is because, even with a partner, the City will likely be required to finance some portion of a fiber network, and especially if it opts to retain ownership and control of the network. Public entities that have good credit ratings and a low cost for bond financing are at an advantage and are attractive to potential partners.

While not every partnership will require the City to pursue bonding, all potential private partners will likely request some contribution from the community. One partnership structure that may be particularly desirable to the City entails the public sector owning and operating the infrastructure while a private partner either lights the fiber and offers retail services over it or leases dark fiber to support a targeted wireless deployment. In this scenario, the City would likely need to bond to fund construction of the network.

We discuss here some of the common types of bonds that public entities typically rely on for capital projects, and the advantages and disadvantages of each. Please note that the following is a summary, does not include every financing mechanism available, and does not offer any legal or tax advice.

#### 5.1.1 General Obligation Bonds

General obligation bonds are directly tied to the public entity's credit rating and ability to tax its citizens. This type of bond is not tied to revenue from any specific project but is connected instead to communitywide taxes and revenues that can be used to repay this debt.

General obligation bonds can be politically challenging because they generally require a public approval process. These bonds are usually issued for projects that will clearly serve the needs of the entire community, such as roadway improvements. While it is our opinion that a fiber enterprise serving the public clearly meets this condition, incumbent opposition is likely. If seeking this type of financing, the City will need to develop a clear vision for its messaging to convey to the community that it intends for the fiber network to enhance the lives of all residents. A model that opens access to the fiber to multiple providers may support general obligation

bonding because it would enable new and existing providers to offer new services and give consumers a choice and alternatives.

It may be especially helpful if the City can work within existing initiatives and with other public, quasi-public, and private institutions to demonstrate how the fiber network can effectively benefit the entire community.

### **5.1.2 Revenue Bonds**

Revenue bonds are directly tied to a specific revenue source to secure the bond and guarantee repayment of the debt. For example, the revenue stream from a public entity's electric, natural gas, or water utility may be used to secure a revenue bond.

Theoretically, any service that generates some sort of revenue that could be used to repay debt might potentially be used to secure a revenue bond; publicly owned transportation services or hospitals are two examples. But while the revenues generated from owning a fiber optic network and leasing it to providers could ostensibly be used to guarantee a revenue bond, this is typically not an accepted practice within the bonding community. Municipal broadband projects without a proven revenue stream are usually viewed as high-risk in the bonding community, and the projected revenues from the network will likely be viewed as too uncertain to support repayment of the loan. Given this, revenue bonds secured with projected fiber revenue are not a strong candidate for financing a fiber network.

## **5.2 Potential for Grant Funding**

This section briefly analyzes Wildwood's potential eligibility for a selection of broadband funding programs. We found that it is unlikely that Wildwood will be eligible for any current funding programs.

At this time, the State of Missouri doesn't offer any broadband grant opportunities that apply to Wildwood. In July of 2018, the state created a Broadband Development Office<sup>11</sup> with the intention of helping rural areas find federal sources of funding to address the lack of broadband. Additionally, the state legislature has created a grant program designed specifically to address rural broadband needs.<sup>12</sup> Final rules and funding for this effort likely won't be available in the

---

<sup>11</sup> Also referred to as the 'Office of Broadband.' This is a joint venture between the state Department of Agriculture and Department of Economic Development that is meant to "...help communities navigate federal programs to bring broadband networks where only expensive or low quality internet access exists." See

<https://news.stlpublicradio.org/post/new-state-office-seeks-bring-high-speed-internet-rural-missouri#stream/0> and See <https://ded.mo.gov/content/department-names-broadband-director>. Accessed April 2019.

<sup>12</sup> SS HCS HB 1872 – MISSOURI RURAL BROADBAND DEVELOPMENT. See

<https://house.mo.gov/billtracking/bills181/sumpdf/HB1872T.pdf>

next year<sup>13</sup> and given the focus on rural areas, this program is not likely to be helpful to Wildwood.

In terms of federal funding opportunities, most are aimed at unserved and underserved areas or economically distressed areas—which essentially means Wildwood would not be eligible, because it is considered served by broadband (defined in this context as 10 Mbps download, 1 Mbps upload) and is not economically distressed. Our review of potential federal funding opportunities included the current ReConnect opportunity through U.S. Department of Agriculture (USDA), the Department of Commerce’s Economic Development Administration (EDA) Public Works and Economic Adjustment programs, the FCC Universal Service Administrative Company (USAC) Schools and Libraries Program (commonly called E-rate) and Healthcare Connect Fund (HCF), as well as the USDA Community Connect program. We provide a brief overview of each below and discussion on eligibility. We note that additional smaller opportunities may emerge in any given year.

As noted above, the majority of funding programs aimed at providing financial support for broadband are designed for communities that are economically distressed and/or are located in areas where available broadband services are less than 10 Mbps download and 1 Mbps upload speeds (10/1 Mbps). Demographic criteria relating to unemployment, population density, and per capita income preclude Wildwood from receiving assistance from federal programs supporting broadband expansion<sup>14</sup>. Other funding options, such as USACs E-rate and HCF programs, require Wildwood to act as a service provider and bid against other service providers in a competitive process<sup>15</sup> in order to realize funding. This would, of course, require Wildwood to first become a service provider.

### **5.3 Wildwood Is Not Eligible for Most Broadband Funding Opportunities at This Time**

In this section we summarize existing funding programs, for your reference. We note at the outset that Wildwood is not eligible for these programs.

---

<sup>13</sup> Missouri still looking to expand rural broadband access. See <https://www.missourinet.com/2018/12/31/missouri-still-looking-to-expand-rural-broadband-access/>. Accessed April 2019.

<sup>14</sup> We also looked at Form 477 data reported to the FCC by providers. While this data is not considered fully reliable by most, it does indicate that Wildwood in general has more than 1 provider offering services that meet or exceed minimum requirements (defined as speeds at least 10/1 Mbps).

<sup>15</sup> While state law prohibits municipalities, generally, from selling or leasing telecommunications services to the public, education and healthcare uses are exempted from such prohibitions. See <http://www.baller.com/wp-content/uploads/BallerStokesLideStateBarriers3-1-19.pdf> accessed April 2019.

### 5.3.1 USDA ReConnect

The Consolidated Appropriations Act of 2018 (known colloquially as “the Omnibus”) earmarked \$600 million for a grant and loan pilot program administered by the U.S. Department of Agriculture’s (USDA) Rural Utility Service (RUS) to encourage broadband infrastructure deployment in rural areas with services that are less than 10/1 Mbps speeds.<sup>16</sup> In addition to a large amount of financial and technical information, the program requires that applicants propose projects within a defined service area (proposed funded service area or ‘PFSA’) that lacks sufficient access to 10/1 Mbps services, and is not considered a prior funded service area (such as a CAF II, RUS broadband loans, RUS BIP grants, or areas that are considered ‘State-funded’).

Wildwood is not sufficiently rural to qualify for the program.

### 5.3.2 USDA Community Connect

USDA Community Connect is a modestly sized highly-competitive grant<sup>17</sup> program for local and tribal governments that targets broadband deployment to unserved (defined as speeds less than 10/1 Mbps), low-income rural communities with fewer than 20,000 residents. Grantees must ultimately offer service at the broadband grant speed (defined as 25/3 Mbps) to *all* households and community institutions in the PFSA, with free service for at least two years to a community center.

Wildwood is not sufficiently rural in population size to be eligible for the program as the applicant<sup>18</sup>.

### 5.3.3 Economic Development Administration

The Department of Commerce’s Economic Development Administration (EDA) has provided economic assistance to distressed communities for many years. Public broadband projects in economically distressed communities are eligible for funding under the Public Works and Economic Adjustment Assistance programs<sup>19</sup> if they are able to show a defined economic

---

<sup>16</sup> “Secretary Perdue Applauds Broadband Investment Included in Omnibus,” USDA, <https://www.usda.gov/media/press-releases/2018/03/23/secretary-perdue-applauds-broadband-investment-included-omnibus>, accessed August 2018.

<sup>17</sup> This program also offers loans.

<sup>18</sup> Census data indicates that between the year 2000 and 2010, population grew approximately 8%. Between 2010 and 2017, population estimates are essentially identical to 2010 numbers (roughly 35,517 people live in Wildwood, MO). See <https://www.census.gov/data/tables/2017/demo/popest/total-cities-and-towns.html> accessed April 2019.

<sup>19</sup> EDA also awards funding under a Disaster Supplemental grant program. See <https://www.eda.gov/funding-opportunities/> for more detail. Accessed April 2019. These grants are given on a case-by-case basis and are usually reserved for extreme circumstances and unforeseen events. If the Wildwood were to experience such an event, it may be able to use EDA funding to restore the availability of services that were incapacitated—but it would not be able to use those funds to expand the availability of broadband.

benefit<sup>20</sup>. The program awards grants of up to \$3 million (and requires a 50 percent cash or in-kind match). Basic eligibility requirements include demonstration of economic distress through official unemployment data showing 1 percent higher rates than the national average over the most recent 24-month period or per capita income that is 80 percent or less than the national average as reported by most recent data. There are additional ‘special need’ categories, such as the imminent closure of a business in the region that will directly affect jobs, or the significant outmigration of population; however, these categories often require additional and significant detail to qualify the proposed project as eligible<sup>21</sup>.

We reviewed applicable unemployment data and per capital income data and determined that Wildwood would not be able to demonstrate the economic distress required to be eligible for funding through EDA as both datapoints outperformed national averages (local unemployment is lower than the national average; per capita income is higher than the required eligibility threshold). Finally, research did not indicate that there were any potential imminent employment closures or loss of population in the most recent 24 months or a trend in population loss over the last 20 years<sup>22</sup> that would indicate imminent economic distress. Wildwood is not currently eligible to apply for this support mechanism.

#### 5.3.4 USAC – E-rate

The federal Schools and Libraries universal service support mechanism (known as “E-rate”) is administered through the Universal Service Administrative Company (USAC) under the authority of the Federal Communications Commission (FCC). The E-rate program provides discounts to schools and libraries (“Customers”) for telecommunications and internet access.

In simple terms, E-rate is a discount program that funds defined eligible services to schools and libraries based on a combination of (1) degree of rurality and (2) local participation in the free and reduced school lunch program. If a school’s monthly bill for internet services is \$100, and the school has a calculated discount of 70 percent, the school pays \$30 and E-rate pays \$70. Applicants (schools or libraries) can receive up to a 90 percent discount on eligible services.

Wildwood – unless it started offering better than 10 Gbps services over fiber for almost no cost – would not be able to compete with services the schools<sup>23</sup> in the immediate area are already receiving. A review of publicly available data from USAC for funding requests made by the

---

<sup>20</sup> Typically, EDA looks for defined metrics related to job growth, such as jobs saved or added as a direct result of the proposed project effecting the marketplace.

<sup>21</sup> Ibid.

<sup>22</sup> Census data indicates that between the year 2000 and 2010, population grew approximately 8%. Between 2010 and 2017, population estimates are essentially identical to 2010 numbers (roughly 35,517 people live in Wildwood, MO). See <https://www.census.gov/data/tables/2017/demo/popest/total-cities-and-towns.html> accessed April 2019.

<sup>23</sup> There are no library sites within the limits of Wildwood.

Rockwood School District for the next E-rate funding cycle shows that the schools are well served and are not over-paying, relative to similarly sized districts, for the services they receive<sup>24</sup> (all sites receive 1/1 Gbps WAN services or better from Charter).

### 5.3.5 USAC – Healthcare Connect Fund

The Healthcare Connect Fund (HCF) is also administered through the Universal Service Administrative Company (USAC) under the Wireline Competition Bureau of the FCC. USAC oversees this opportunity as well as E-rate, and the two application processes and programs have significant similarities.

The HCF provides a 65 percent subsidy for broadband service to eligible healthcare providers and facilities. While the focus is on serving rural facilities, teaching hospitals and urban/suburban facilities are eligible if they are part of an in-state consortium that includes rural facilities. Keep in mind that the HCF is intended to provide Health Care Providers (HCP) access to broadband services, particularly in rural areas, and to encourage the formation of state and regional broadband networks linking HCPs. While the program is intended to benefit rural providers, consortia of urban and rural providers may also participate, so long as the majority of the members of the consortia (at least 51 percent) are rural.

To participate in HCF and provide services to HCPs benefiting from the subsidy, Wildwood would have to compete against other providers bidding for contracts with those HCPs utilizing the HCF mechanism for funding. There also is little control of this process for a provider as it relies on the stated needs of HCPs and therefore, little ability to plan or strategize until an RFP has been issued by an HCP.

---

<sup>24</sup> The Rockwood School District enjoys a 40% discount on Category 1 and Category 2 services. The 2019-2020 Form 471 Funding request for WAN services to all sites in the district totaled approximately \$221,000 before the 40% discount from E-rate (which is approximately \$88,000). Rockwood will pay approximately \$133,000 out of pocket for services that have a minimum connection of 1 Gbps to most sites. Form 471 data is publicly available through the USAC E-rate Productivity Center, which requires a login to access. Retrieved April 2019.

## 6 Middle Mile and Dark FTTP Financial Analysis

This section investigates the costs of owning and operating a middle mile fiber network and a dark FTTP network. The analysis includes necessary financing, capital additions, test equipment, and network operations and maintenance expenses. Our analysis illuminates the total cost to finance, deploy, maintain, and operate the network. The costs in this model are comprehensive, including labor, replacement of test and other equipment, and fiber maintenance costs for the lifetime of the model.

### 6.1 Middle Mile Cost of Ownership

The cost to deploy a fiber network goes far beyond fiber implementation. Network deployment requires maintenance and technical operations, support personnel, and other functions. The model assumes a straight-line depreciation of assets, and that the fiber will have a 20-year life span and the management software and test equipment will have a 5-year life. We have not included any costs associated with the electronics to light the fiber, as these costs in this model are the responsibility of the internet service provider (ISP) or other entity.

In addition to the \$4.32 million in the middle fiber, we have included \$80,000 in test equipment and fiber management system software.

The resulting cost of ownership of the middle mile fiber estimate is \$434,300 per year, which consists of:

- Debt service payment (P&I) of \$336,300 per year,
- Operating & maintenance expenses of \$82,000 per year, and
- Depreciation reserve (for the replacement of test equipment and software every 5 years) of \$16,000 per year

#### 6.1.1 Operations and Maintenance Expenses

Operations and maintenance assumptions include:

- Locates and ticket processing are estimated at \$40 per month per mile of underground fiber, resulting in \$11,100 once the middle mile fiber is fully deployed.
- Insurance is estimated at \$5,000 in year 1, then \$10,000 in year 2 and beyond.
- Fiber maintenance and repair fees are estimated at \$375 per year per fiber route mile.
- Legal and other support is estimated at \$20,000 in year one only.
- Contingency is estimated at \$5,000 in year 1, then \$10,000 in year 2 and beyond.

- GIS support for record keeping is estimated at \$5,700 per year.

With the exception of GIS support, expenses are inflated by 2 percent per year. GOS support expenses are inflated by 3 percent per year (GIS support is primarily labor, while others are a mix of labor and materials). The summary of the O&M costs is shown in Table 11.

**Table 11: Middle Mile Fiber Network Operating and Maintenance (O&M) Expenses**

Expense	Year 1	Year 3	Year 5	Year 10
Locates & Ticket Processing	\$2,800	\$11,550	\$12,010	\$13,260
Insurance (liability)	5,000	10,400	10,820	11,950
Fiber Maintenance (breaks and other)	21,700	45,260	47,080	51,980
Legal & Other Support	20,000	-	-	-
Contingency	5,000	10,400	10,820	11,950
GIS Support	<u>5,700</u>	<u>6,100</u>	<u>6,400</u>	<u>7,500</u>
Total O&M Expenses	\$60,200	\$83,710	\$87,130	\$96,640

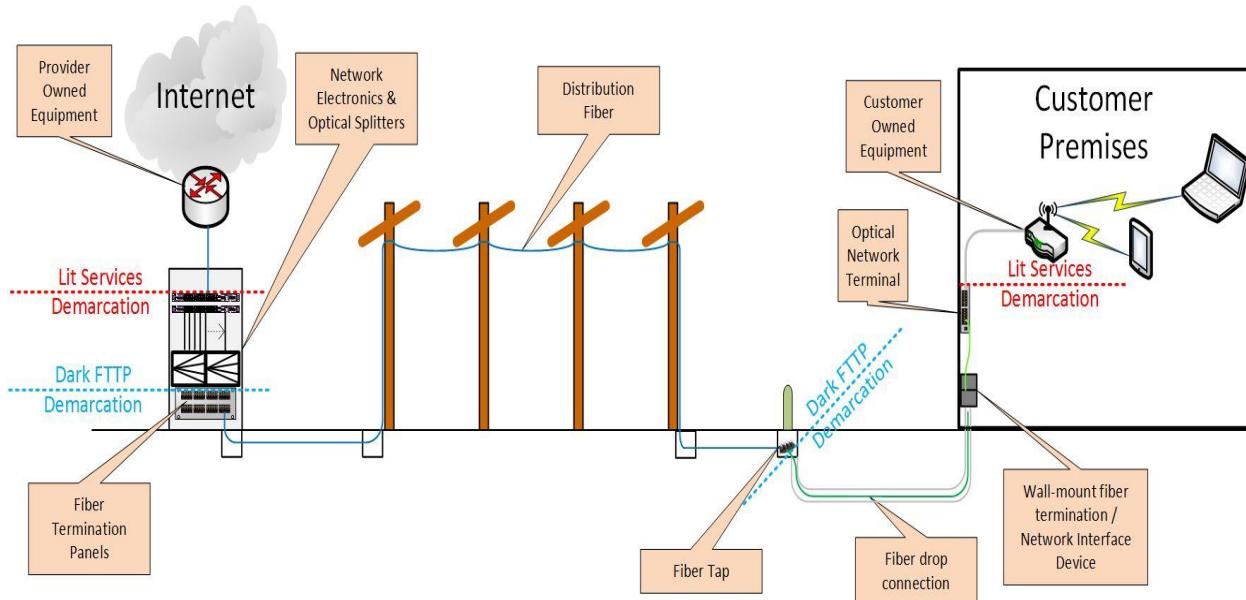
### 6.1.2 Financing Costs

For the analysis we assume that the City will cover all its capital requirements with 20-year GO bonds totaling \$4.42 million. We assume the bond rate will be 4 percent. The resulting principal and interest (P&I) payments will be the major factor in determining the City's long-term financial requirements.

We project that the bond issuance costs will be equal to 1 percent of the principal borrowed. For the bond, we assume neither a debt service nor interest reserve account are required. Principal repayment on the bonds will start in year two. This results in a year 1 interest payment of \$176,680 in year 1 and an P&I payment of \$336,300 starting in year 2.

## 6.2 Dark FTTP Cost of Ownership

In a dark FTTP model the City would deploy fiber infrastructure for lease to a private partner but would not deploy the fiber drop cable that connects the customer's premises to the FTTP network or add any electronics. The private partner would be responsible for constructing the fiber drop cables and providing network electronics and customer premises equipment (CPE) to offer retail services. Because this model is based on the agreement between Huntsville (Ala.) Utilities and its private partner, Google Fiber, we refer to it as the Huntsville model.

**Figure 15: Demarcation Between City and Partner Network Elements (Huntsville Model)**

It should be noted that fiber drop costs, network electronics and CPE are significant additional expenses.

### 6.3 Dark FTTP Cost of Ownership

The financial analysis summary presented in this section represents a minimum requirement for the City to obtain a break-even cash flow each year. We have provided a complete financial model in Excel format (Appendix C) that can be leveraged to show the impact of changing assumptions.

The dark FTTP model is summarized by:

- Initial investment of \$29.01 million to pass all residents in the low-density area of Wildwood. The investment cost includes test equipment and fiber management software, and Includes 55 percent of the middle-mile network
- Initial bonding of \$31.33 million over three years. We assume 20-year GO bonds at 4 percent. We project that the bond issuance costs will be equal to 1 percent of the principal borrowed. For the bond, we assume neither a debt service nor interest reserve account are required. Principal repayment on the bonds will start in after the year of issuance. This results in a P&I payment of \$2.39 million
- Operating & maintenance expense are estimated at \$450,000 per year (see Appendix D for details)

- Maintain a depreciation reserve of \$29,360 per year for replenishments of test equipment and fiber management software

This results in a required fee of \$69 per month per passing in order to maintain positive cash flow.

In our modeling, we compared a similar FTTP deployment in the city of Huntsville, Ala. In its contract with Google Fiber, Huntsville Utilities negotiated a monthly per-passing fee of \$7.50. We include this reference to demonstrate what pricing is attractive enough to incent partnership, the financial implications of that pricing, as well as what Huntsville pricing would look like in relation to network deployment costs for the City. If the City were to charge similar lease fees as those paid by Google in Huntsville, it will result in cumulative cash deficits of almost \$48 million after 20 years.

As indicated above, the required fee in order to maintain positive cash flow is \$69.00 per passing per month, 9.2 times than those paid by Google in Huntsville. It is also important to note that the \$9 per month per passing is for 100 percent pf all home and does not include drop cost or services fees for households requesting service.

## **Appendix A: Cooperative Model**

An example of a model in which an ISP forms a cooperative with a neighborhood is provided as separate document.

## Appendix A: Cooperative Example

### Case Study: Doe Bay Internet Users Association

Living on the eastern edge of an island in the middle of Puget Sound, residents of Doe Bay, WA, were limited to DSL as their only wireline internet option—and all the DSL providers depended on CenturyLink’s copper wires, which offered speeds well below the FCC’s definition of broadband and were prone to extended outages. In late 2013, all services that depended on CenturyLink went out for ten days due to a severed underwater cable.<sup>1</sup>

Around this time, the community began looking for ways to improve its broadband options. When it became clear that no ISPs were willing to make the investment necessary to enable better service, they decided they could solve the problem themselves. They formed a nonprofit—the Doe Bay Internet Users Association (DBIUA)—and took it upon themselves to design, build, operate, and maintain a wireless network that would meet the broadband needs of their community. The network began providing wireless service to members in June 2014; by December of that year, members were reporting some of the fastest download speeds on the island.<sup>2</sup>

Today, DBIUA has grown to more than 60 members. They paid back their initial start-up loan a year early, purchased back-up equipment for when their radios fail, and still have been able to lower the rates members pay for service.<sup>3</sup> A core group of members volunteer most of the labor necessary to deploy, maintain and upgrade the network. The network provides download and upload speeds ranging from 5 Mbps to 50 Mbps, depending on where a user is on the network and the overall number of users. Unlike all other providers available at the time it launched, DBIUA offered users symmetrical throughput<sup>4</sup> with no data caps or throttling.<sup>5</sup> Though maintaining a wireless network requires a fair amount of ongoing monitoring and maintenance, DBIUA has proven that a dedicated group of neighbors can steward its own last-mile wireless network as well as any private ISP.

---

<sup>1</sup> Brodkin, Jon. “How a Group of Neighbors Created Their Own Internet Service.” ArsTechnica. <http://www.arstechnica.com/information-technology/2015/11/how-a-group-of-neighbors-created-their-own-internet-service/> (accessed July 23, 2018).

<sup>2</sup> Doe Bay Internet Users Association. “Fastest Internet Speeds on Orcas.” <http://dbiua.org/2014/12/21/fastest-internet-speeds-on-orcas/> (accessed July 23, 2018).

<sup>3</sup> Doe Bay Internet Users Association. “Growing and Costs Going Down!” DBIUA. <http://dbiua.org/2016/02/04/growing-and-costs-going-down/> (accessed July 23, 2018).

<sup>4</sup> Doe Bay Internet Users Association. “Symmetrical Throughput.” DBIUA. <http://dbiua.org/symmetrical-throughput/> (accessed July 23, 2018).

<sup>5</sup> Doe Bay Internet Users Association. “An Un Throttled Experiment.” DBIUA. <http://dbiua.org/2016/02/10/an-un-throttled-experiment/> (accessed July 23, 2018).

## 1 Spreading a Wholesale Connection Across a Community

No one in the group is a professional network engineer, but Chris Sutton, one of the founding members, is a software developer with experience in server and network management.<sup>6</sup> His experience has been instrumental in getting the network set up and troubleshooting problems that arise. He documents DBIUA's success and failures and provides a detailed technical description of the network on DBIUA's website.<sup>7</sup>

DBIUA purchases wholesale internet connections from two providers and distributes the connection to members' households using a variety of wireless radios. Initially, no wired providers were willing to offer an affordable wholesale rate for backhaul to the internet, but wireless towers on the mainland are just 10 miles from Doe Bay. DBIUA was able to purchase a licensed microwave connection from Bellingham-based StarTouch for \$11,000. The microwave connection comes in to a 50-foot water tower, the only structure tall enough to serve as a point-to-point link to a tower on the mainland.<sup>8</sup> In 2016, they negotiated an additional wired connection for \$900 a month from Rock Island Communications, an ISP owned by the local electric cooperative.<sup>9</sup> Their network gateway now divides traffic across these two connections.<sup>10</sup>

At the base of the water tower is a Cisco switch that connects back to three radios on top of the tower; those radios distribute the connection to more than 200 additional radios located in trees, on poles, and on members' rooftops. They use a combination of point-to-point and point-to-multipoint Ubiquiti rocket radios (though some have now been upgraded to Ubiquiti Iso and Prism Stations).

Almost all of the radios operate in the unlicensed 5.8 GHz and 900 MHz bands, with the exception of one radio that uses the 3.65 GHz band.<sup>11</sup> The mountainous terrain and towering trees pose a serious challenge to signal propagation, and the group lacked the funds to build wireless towers, so they used a drone to determine which trees had the clearest line of sight to the previous network node. They then hired tree climbers to install radios in trees with the best views.

---

<sup>6</sup> Brodkin, Jon. "How a Group of Neighbors Created Their Own Internet Service." ArsTechnica. <http://arstechnica.com/information-technology/2015/11/how-a-group-of-neighbors-created-their-own-internet-service/> (accessed July 23, 2018).

<sup>7</sup> Doe Bay Internet Users Association. "Technical Details." DBIUA. <https://dbiua.org/technical-details/> (accessed August 20, 2018).

<sup>8</sup> Brodkin, Jon. "How a Group of Neighbors Created Their Own Internet Service." ArsTechnica. <http://arstechnica.com/information-technology/2015/11/how-a-group-of-neighbors-created-their-own-internet-service/> (accessed July 23, 2018).

<sup>9</sup> Initially, Rock Island refused to provide them with a wholesale rate because it did not believe they were an ISP.

<sup>10</sup> Doe Bay Internet Users Association. "Net Neutrality." DBIUA. <http://dbiua.org/2017/12/15/net-neutrality/> (accessed July 23, 2018).

<sup>11</sup> Doe Bay Internet Users Association. "Radios We Use." DBIUA. <http://dbiua.org/2016/02/29/radios-we-use/> (accessed July 23, 2018).

Ubiquiti NanoStations receive the signal close to members' homes<sup>12</sup> and Ubiquiti airRouters bring the signal into the home and create a Wi-Fi network for end users.<sup>13</sup> Sutton explains that at the outset, the group decided on one equipment vendor, and he does not regret his decision to use Ubiquiti equipment. However, now that they are more financially stable, he has switched to more reliable (but more difficult to configure) Cisco edge routers.<sup>14</sup>

### 1.1.1 Network Expands and Rates Fall

The idea for the network came from a small group of neighbors who realized a microwave connection was their only option for better broadband but could not afford the connection on their own. They brought the idea to a local potluck and found plenty of neighbors desperate for an alternative to DSL. They put together a budget and estimated they would need roughly \$25,000 to cover the capital cost of equipment and the installation of the microwave receiver. To pay back a \$25,000 loan in three years and cover the ongoing bandwidth costs, they needed to find 23 households willing to pay \$75 per month, plus \$125 in equipment fees.

They were the only ISP in the area offering broadband without data caps, so demand for their service was intense. As more neighbors signed up, they were able to use new members' properties to place more relay points and extend the signal to additional areas. Members were happy to let DBIUA install radios in well-positioned trees, open fields and rooftops to help them connect additional neighbors.

By early 2016, DBIUA had grown to more than 60 members. This left DBIUA flush with enough cash to pay back its loan a year early, add an additional backhaul connection from a local wired provider, buy back-up equipment, and create a healthy reserve fund.<sup>15</sup>

When they still had excess cash, they decided to lower their rates. Instead of dropping their rate outright, they took a phased approach where the price members pay decreases the longer they are members. For the first 18 months, new members pay \$75 a month. Then the price drops to \$65 for six months, and then \$55 for six months, bottoming out at \$45 a month for members who have been with DBIUA for three years or more.<sup>16</sup>

---

<sup>12</sup> Doe Bay Internet Users Association. "Radios We Use." DBIUA. <http://dbiua.org/2016/02/29/radios-we-use/> (accessed July 23, 2018).

<sup>13</sup> Doe Bay Internet Users Association. "My Favorite Ubiquity Wifi Router." DBIUA. <http://dbiua.org/2016/02/18/my-favorite-ubiquity-wifi-router/> (accessed July 23, 2018).

<sup>14</sup> Doe Bay Internet Users Association. "Ubiquity vs Cisco." DBIUA. <http://dbiua.org/2016/01/28/ubiquity-vs-cisco/> (accessed July 23, 2018).

<sup>15</sup> Doe Bay Internet Users Association. "Orcas Internet Options." DBIUA. <http://dbiua.org/2016/01/30/orcas-internet-options/> (accessed July 23, 2018).

<sup>16</sup> Doe Bay Internet Users Association. "Orcas Internet Options." DBIUA. <http://dbiua.org/2016/01/30/orcas-internet-options/> (accessed July 23, 2018).

Even with this new pricing structure, DBIUA continues to build up its reserve funds, so in June 2017, it had its first “No Fee” month, during which members were not charged for service.<sup>17</sup>

### 1.1.2 The Challenges of Having No One to Call When Something Goes Wrong

DBIUA consistently provides a faster and more reliable connection than CenturyLink but keeping a wireless network humming along through rough Pacific Northwest winters is not without its challenges. Atmospheric conditions can reduce signal strength and slow the bitrate, and sometimes users experience outages.

Sutton generally leads the task of troubleshooting and shares his finding on the group’s website. He uses Nagios, an open source network watchdog program, to monitor the network and Cacti, an open source data logging program, to record uptime, ping time, signal strength, noise, bitrate, and bandwidth every five minutes. These programs provide valuable information when a member reports a problem.<sup>18</sup> DBIUA has also begun experimenting with adding Raspberry Pi computers to access point equipment boxes to monitor battery voltage and run speed tests to help predict outages before they occur.

Many of the problems stems from a radio losing power. Sometimes they just need to ask another member to flip the breaker in their breaker box. Other times someone needs to adjust or re-crimp a power cable. Early on, they learned the limits of how many radios can be daisy chained together off a single Power over Ethernet (POE) cable.<sup>19</sup> They also learned how to factor in line loss when carrying power over longer distances.<sup>20</sup>

The most dramatic form of network failure is radios becoming dislodged from the tree, which happened for the first time this past winter.<sup>21</sup> They diagnosed the problem themselves with a drone, but fixing it required professional tree climbers and good weather for tree climbing, which is in short supply on Orcas Island in the winter. When an important relay point failed high up in a tree in the midst of bad weather, they added an additional radio to another site and modified the network to make sure everyone had some coverage while they waited for a clear day for a tree climber to reinstall the radio. Without access to towers, bucket trucks and line crews, DBIUA members are somewhat at the mercy of the weather.

---

<sup>17</sup> Doe Bay Internet Users Association. “No Fee Month.” DBIUA. <http://dbiua.org/2017/05/09/no-fee-month/> (accessed July 23, 2018).

<sup>18</sup> Doe Bay Internet Users Association. “Troubleshooting.” DBIUA. <http://dbiua.org/2016/03/30/troubleshooting/> (accessed July 12, 2018).

<sup>19</sup> Doe Bay Internet Users Association. “Troubleshooting.” DBIUA. <http://dbiua.org/2016/03/30/troubleshooting/> (accessed July 12, 2018).

<sup>20</sup> Doe Bay Internet Users Association. “Line Loss.” DBIUA. <http://dbiua.org/2016/03/30/line-loss/> (accessed July 12, 2018).

<sup>21</sup> Doe Bay Internet Users Association. “Rough Winter.” DBIUA. <http://dbiua.org/2018/02/28/rough-winter/> (accessed July 12, 2018).

### 1.1.3 Limits of a Volunteer-Run Organization

A large part of DBIUA's success stems from the dedicated volunteer labor of a core group of members. Chris Sutton has been instrumental as a technical advisor, and many members lend a hand to install and maintain the radios. Administrative burdens are minimal thanks to software Sutton adapted that keeps track of the radios and automatically bills members' credit cards each month.<sup>22</sup>

Still, relying on volunteer labor has its limits. The members with the technical knowledge to install and maintain radios have a limited amount of spare time they can dedicate to this project, and the network has reached a point of complexity where simply maintaining it could be a part-time job. The group decided to stop taking new members in October 2016, partially because another ISP began offering fixed LTE service in the neighborhood. However, Sutton also cited not having enough time to complete additional installations.<sup>23</sup>

Instead of expanding, DBIUA is refining its existing network. It continues to deliver symmetrical broadband service to its members on a remote island at a price even many large urban ISPs cannot beat. They have backup equipment and a growing reserve fund. Rock Island and T-Mobile are entering the market but can hardly compete with unlimited service and no data caps for \$45 per month. DBIUA has found a sustainable business model, as long as the volunteer labor does not dry up. The group is proof that a dedicated group of neighbors with some technical knowledge can solve the challenge of providing last-mile connectivity with their own ingenuity and hard work.

## 1.2 Cooperating to Overcome Traditional Barriers, or “Internet in a Box”

The high cost to enter the broadband market for small providers can be extremely challenging, especially for those that aim to serve areas that may not have a quick or complete return on investment (ROI). Although there are steps public entities can take to support traditional providers, such as WISPs, it may also be necessary to focus on alternative approaches—particularly to bring better connectivity to extremely rural areas. In areas where population density is very low, and a substantial investment in expensive network infrastructure and equipment would be necessary to support only a handful of customers, it is often simply not feasible for a traditional provider to increase speeds or upgrade their network.

Enabling and supporting fixed wireless connectivity is an important way that public entities can help expand service availability. Beyond that, there are emerging new technologies and practices that may bridge gaps in areas where even traditional fixed wireless service is not financially

---

<sup>22</sup> Doe Bay Internet Users Association. “Billing System.” DBIUA. <http://dbiua.org/2016/04/28/billing-system/> (accessed July 12, 2018).

<sup>23</sup> Doe Bay Internet Users Association. “No New Members.” DBIUA. <http://dbiua.org/2016/10/06/no-new-members/> (accessed July 12, 2018).

feasible. There may be demand in these areas, but some may be so remote that there simply is not a significant enough ROI to deploy substantial infrastructure and equipment. Moreover, fixed wireless service may rely on only one access point to serve many customers and customers over a long range, which results in diminished service quality, widening the availability gap even further for rural users.

As demand for greater connectivity increases and more private and public entities seek to do more with less, creative solutions to solve connectivity issues are beginning to emerge. Rural WISPs may be limited in their ability to place wireless access points due to limited physical locations that are high enough and rated for wireless connectivity. Even in areas where towers exist, there may be limited backhaul, or the available circuits may be cost prohibitive.

Common barriers to fixed wireless deployment in rural areas include accessing dependable and robust backhaul, aggregating sufficient demand, and obtaining mounting assets and power for antennas. It is unlikely that larger regional based providers will make an investment in low density rural areas. Even for an innovative provider, the costs make it difficult to achieve even a break-even cash flow, much less obtain a sufficient ROI. Recently, smaller communities have addressed these issues by leveraging their specific circumstances and collective strength to deploy smaller neighborhood networks. That is, provided the community can surmount the traditional obstacles, it can deploy the “internet in a box.”

In an “internet in a box” deployment, a group of potential customers (e.g., a homeowner or neighborhood association, community group, etc.) would form a broadband entity<sup>24</sup> that can coordinate with a backhaul provider, the owner(s) of potential mounting assets, and an energy provider to obtain affordable connectivity, attachments, and power. From there, using wireless assets purchased from a specialized equipment vendor, such as California-based Mimosa Networks, the community can develop and deploy a network to support its users’ needs. We note that Mimosa is not just an equipment vendor—it also provides user-friendly interfaces and front-end management tools to administer and manage the network.

### 1.3 Small Communities Face a Challenge of Scale

While it may seem that the cost to deploy in a smaller City would be lower than in a larger city, the opposite tends to be true. This is especially true if the City itself seeks to become the ISP offering service to end users. Typically, a public entity lacks the economies of scale that a larger provider will have in place to support such a deployment. For example, an existing service provider with a footprint in multiple locations can rely on customer service staff to support several markets, whereas a small locality must either contract or provide specialized staff for such functions. Similarly, providers tend to have existing relationships with vendors that enable

---

<sup>24</sup> The exact structure of any such deployment would depend on the group(s) taking on the deployment

discounts and other cost reductions that simply are not available to public entities that seek to enter the retail market. Further, a phased deployment will tend to be even more expensive over the long term than a ubiquitous deployment.

## **Appendix B: Advantages and Disadvantages of All Models**

A full table describing the advantages and disadvantages of all models is provided as a separate document.

## Appendix B – Advantages and Disadvantages of All Approaches

Approach	Advantages	Disadvantages	Example	Comment
<b>A. City Offers Retail Services</b>  City owns and operates the FTTP network (OSP and electronics) and provides retail services	City controls when and how its residents and businesses get served	Extremely difficult to maintain positive cash flow; may require significant support from general fund and contributions from households or other sources	Chattanooga TN (municipal electric utility)	Extremely high risk (financial and operational)
	City controls service performance attributes	Requires City to become retail provider, a role with which it has no experience		Model is more difficult (operations, financing, and cash flow) when the City is not associated with a municipal electric utility
	City owns infrastructure OSP	Requires City to become network operator, a role with which it has no experience		All FTTP models impacted by the high cost in western portion of city due to the low household density
		Requires periodic replacement of electronics (City responsibility)		
		Extremely high cost to deploy FTTP in western portion of the city		Substantial funding from households to support buildup costs in western portion of the city likely required
		Requires City to become a registered CLEC in MO for pole attachments (an Ameren requirement) or do all construction underground		City legal input required
<b>B. City Enables Open Access</b>  City owns and operates FTTP (OSP and electronics) and provides open access services	City controls when and how its residents and businesses get served	Extremely difficult to maintain positive cash flow (may require significant support from general fund and contributions from households or other sources)	UTOPIA (11 Utah municipalities)	Extremely high risk (financial and operational)
	City controls service performance attributes	Requires City to become network operator, a role with which it has no experience		U.S. efforts have struggled to attract providers to participate
	Offers consumers multiple retail providers	In U.S. markets, few examples and limited success		Model requires a substantial number of providers to work (based on examples in Europe)
	City owns infrastructure OSP	Providers have different take-rate objectives than FTTP owner and operator (providers will profit at much lower take-rates than what the operator needs to cover costs)		All FTTP models impacted by the high cost in western portion of city due to the low household density
	City not required to provide retail service	Requires periodic replacement of electronics (City responsibility)		Substantial funding from households to support
		High cost to deploy FTTP in western portion of city		

		Requires City to become a registered CLEC in MO (for pole attachments) or do all construction underground		buildout costs in western portion of the city likely required  City legal input required
--	--	---	--	--

Approach	Advantages	Disadvantages	Example	Comment
<b>C. City Enables Open Access Provider</b>  City owns and operates FTTP (OSP); third party owns and operates electronics and provides open access services	City has influence of service performance attributes	Extremely difficult to maintain positive cash flow (may require substantial support from general fund and contributions from households or other sources)	Ammon ID	Extremely high risk (financial and operational)  Uses a \$3,000 connection fee per household to help fund construction and requires at least 60 percent participation before deployment  All FTTP models impacted by the high cost in western portion of City due to the low household density
	Offers consumers multiple retail providers	Providers have different take-rate objectives than FTTP owner and operator (providers will profit at much lower take-rates than what the operator needs to cover costs)		
	City owns infrastructure OSP	Model not proven it can be replicated (in terms of attracting ISPs and other attributes)		
	City has partial control over where OSP is deployed	Risk increases if City required to guarantee revenue to Network Operator		
	City not required to provide retail service	Requires city to become a registered CLEC in MO (for pole attachments) or do all construction underground		Substantial funding from households to support buildup costs in western portion of the City likely required  City legal input required
<b>D. City Leases Dark FTTP</b>  City owns and operates FTTP (OSP); third party owns and operates electronics and provides retail services	City has influence over service performance attributes	Provider payment to access dark FTTP unlikely to cover cost of debt service and operating costs of the dark FTTP	Huntsville AL and Westminster MD	High risk (financial)  In Huntsville, the third party (Google) owns the drops. In Westminster the City owns the drops (Ting provides service)
	City owns infrastructure OSP	Model not proven it can be replicated (in terms of ability to attract ISPs and other attributes)		
	City has controls (partially) where OSP is deployed	High cost to deploy FTTP in western portion of City		
	City not required to provide retail service	City required to become a registered CLEC in MO (for pole attachments) or do all construction underground		All FTTP models impacted by the high cost in western portion of City due to the low household density

				Substantial funding from households to support buildup costs in western portion of the City likely required  City legal input required
<b>E. City Leases Dark Middle Mile</b>  City owns and operates fiber middle-mile; third party owns and operates last mile (OSP and electronics) and provides retail services	Reduces City's financial requirements over FTTP	Provider payment to access dark middle mile unlikely to cover cost of debt service and operating costs of the middle mile fiber	Holly Springs NC and Wake Forest NC	Moderate risk (attracting last-mile providers)  Ting is retail provider in Holly Springs and Wake Forest  All FTTP models impacted by the high cost in western portion of City due to the low household density  Substantial funding (to last-mile provider) required from households to support buildup costs in western portion of the city likely required to achieve ubiquitous coverage  City legal input required

Approach	Advantages	Disadvantages	Example	Comment
F. Offer Cash Incentives  City provides financial incentives to private provider	Relatively low cost (when compared to middle mile options)  Has potential of meeting core objectives (availability and performance) with lower cost than middle-mile fiber  City not required to provide retail service	Potential legal restrictions or hurdles (can City make contribution and not own asset?)  Depends upon ISP decisions on when and where to build (contract requirements might reduce this disadvantage)  No direct recovery of investment		Moderate to low risk (enforcing negotiated requirements)  Spectrum (formerly Charter) provided a proposal to Wildwood based on this approach in 2011  City legal input required
G. Expand Wireless Assets  Expand placement of poles and other assets for WISPs and seek to streamline permitting and other processes for underground fiber placement	Minimizes City's financial requirements  City not required to provide retail service	Minimal impact to availability of broadband in Western portion of City  Unlikely to meet all availability and performance objectives		High risk (reaching objectives)  Low risk (financial)
H. Continue on Same Path  Continue as-is & look at streamlining permitting and other processes for underground fiber placement	Minimizes City's financial requirements  City not required to provide retail service	Minimal impact to availability of broadband in Western portion of City  Unlikely to meet all availability and performance objectives		High risk (reaching objectives)  Low risk (financial)
		Wireless has long term limitations of coverage and performance in western portion of City		
		Limited influence on availability of ubiquitous broadband		

## **Appendix C: Middle Mile Financial Model**

The full working model is supplied as a separate document.

Wildwood MO  
Middle Mile Fiber - Dark  
Rev 2  
Wildwood , MO  
May 19, 2019

## **Middle-Mile Fiber Deployment**

The projections used in this analysis were prepared to assist in the assessment of the financial feasibility of establishing a enterprise to offer connectivity services in the identified service area. Where appropriate, the analysis includes projected operating revenues, expenses, and cash flows for the life of the system based on estimated construction costs and various market penetration rates. This analysis should not be used for any other purpose. There will be differences between the projected and actual results, because events and circumstances frequently do not occur as expected, and those differences may be material. CTC has no responsibility to update or certify

this projection for events and circumstances occurring after the date of this Report.

**Table of Contents**  
**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

<b>Description</b>	<b>Page</b>
Income Statement	3
Cash Flow Statement	4
Capital Additions	5
Principal and Interest Payments (Year 1 Financing)	6
Depreciation	7
Expenses	8
Assumptions	9

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

**Income Statement**

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>a. Revenues</b>										
Transport Services	\$ 261,000	\$ 436,000	\$ 438,000	\$ 440,000	\$ 441,000	\$ 443,000	\$ 445,000	\$ 447,000	\$ 448,000	\$ 450,000
Internet Services (bundled with Internet)	-	-	-	-	-	-	-	-	-	-
Wholesale Open Access	-	-	-	-	-	-	-	-	-	-
Data Center	-	-	-	-	-	-	-	-	-	-
Wireless Connection	-	-	-	-	-	-	-	-	-	-
Transport Services Discount	-	-	-	-	-	-	-	-	-	-
Internet Services Discount	-	-	-	-	-	-	-	-	-	-
Wholesale Access Discount	-	-	-	-	-	-	-	-	-	-
Data Center Discount	-	-	-	-	-	-	-	-	-	-
CAI Capital Contributions	-	-	-	-	-	-	-	-	-	-
Internal Charges and Allocations										
Sponsors	-	-	-	-	-	-	-	-	-	-
Charter Memberships	-	-	-	-	-	-	-	-	-	-
Associate - Level 1 Memberships	-	-	-	-	-	-	-	-	-	-
Associate - Level 2 Memberships	-	-	-	-	-	-	-	-	-	-
Associate - Level 3 Memberships	-	-	-	-	-	-	-	-	-	-
Dark Fiber IRU Payments	-	-	-	-	-	-	-	-	-	-
Network Connections and Splices (Dark Fiber)	-	-	-	-	-	-	-	-	-	-
Dark Fiber Maintenance and Lease Fees - Plus Lateral Fees	-	-	-	-	-	-	-	-	-	-
DIA Sales	-	-	-	-	-	-	-	-	-	-
Customer Equipment Fee (non-recurring)	-	-	-	-	-	-	-	-	-	-
Customer Connection Fee (non-recurring)										
Total	\$ 261,000	\$ 436,000	\$ 438,000	\$ 440,000	\$ 441,000	\$ 443,000	\$ 445,000	\$ 447,000	\$ 448,000	\$ 450,000
<b>b. Operating Expenses - Cash (not including taxes in line h)</b>										
Adjustments and Payments	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Operating & Maintenance Expenses	\$ 54,500	\$ 76,100	\$ 77,600	\$ 79,200	\$ 80,700	\$ 82,400	\$ 84,000	\$ 85,700	\$ 87,400	\$ 89,100
Operating Expenses - Training, Attachments, Utilities	-	-	-	-	-	-	-	-	-	-
Salaries	\$ 5,700	\$ 5,900	\$ 6,100	\$ 6,300	\$ 6,400	\$ 6,600	\$ 6,800	\$ 7,000	\$ 7,200	\$ 7,500
Total	\$ 60,200	\$ 82,000	\$ 83,700	\$ 85,500	\$ 87,100	\$ 89,000	\$ 90,800	\$ 92,700	\$ 94,600	\$ 96,600
<b>c. Revenues less Cash Operating Expenses (a-b)</b>	\$ 200,800	\$ 354,000	\$ 354,300	\$ 354,500	\$ 353,900	\$ 354,000	\$ 354,200	\$ 354,300	\$ 353,400	\$ 353,400
<b>d. Operating Expenses - Non-Cash</b>	\$ 231,800	\$ 231,800	\$ 231,800	\$ 231,800	\$ 231,800	\$ 231,800	\$ 231,800	\$ 231,800	\$ 231,800	\$ 231,800
<b>e. Operating Income (d-c)</b>	\$ (31,000)	\$ 122,200	\$ 122,500	\$ 122,700	\$ 122,100	\$ 122,200	\$ 122,400	\$ 122,500	\$ 121,600	\$ 121,600
<b>f. Non-Operating Income</b>										
Interest Income	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Investment Income	-	-	-	-	-	-	-	-	-	-
Interest Expense (Short-Term)	-	-	-	-	-	-	-	-	-	-
Interest Expense (Long-Term))	(176,680)	(176,680)	(170,300)	(163,650)	(156,750)	(149,570)	(142,100)	(134,330)	(126,250)	(117,850)
Interest Expense (Internal)	-	-	-	-	-	-	-	-	-	-
Total	\$ (176,680)	\$ (176,680)	\$ (170,300)	\$ (163,650)	\$ (156,750)	\$ (149,570)	\$ (142,100)	\$ (134,330)	\$ (126,250)	\$ (117,850)
<b>g. Net Income</b>	\$ (207,680)	\$ (54,480)	\$ (47,800)	\$ (40,950)	\$ (34,650)	\$ (27,370)	\$ (19,700)	\$ (11,830)	\$ (4,650)	\$ 3,750
<b>h. Taxes</b>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>i. Net Income After Fees &amp; In Lieu Taxes</b>	\$ (207,680)	\$ (54,480)	\$ (47,800)	\$ (40,950)	\$ (34,650)	\$ (27,370)	\$ (19,700)	\$ (11,830)	\$ (4,650)	\$ 3,750

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

**Cash Flow Statement**

Year	1	2	3	4	5	6	7	8	9	10
a. Net Income (From Income Statement)	\$ (207,680)	\$ (54,480)	\$ (47,800)	\$ (40,950)	\$ (34,650)	\$ (27,370)	\$ (19,700)	\$ (11,830)	\$ (4,650)	\$ 3,750
<b>b. Cash Outflows</b>										
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Interest Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Depreciation Operating Reserve	\$ -	\$ (16,000)	\$ (16,000)	\$ (16,000)	\$ (16,000)	\$ (16,000)	\$ (16,000)	\$ (16,000)	\$ (16,000)	\$ (16,000)
Financing	\$ (44,000)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Capital Expenditures	\$ (4,395,000)	\$ -	\$ -	\$ -	\$ -	\$ (80,000)	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	<b>\$ (4,439,000)</b>	<b>\$ (16,000)</b>	<b>\$ (16,000)</b>	<b>\$ (16,000)</b>	<b>\$ (16,000)</b>	<b>\$ (96,000)</b>	<b>\$ (16,000)</b>	<b>\$ (16,000)</b>	<b>\$ (16,000)</b>	<b>\$ (16,000)</b>
<b>c. Cash Inflows</b>										
Interest Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Depreciation Operating Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 80,000	\$ -	\$ -	\$ -	\$ -
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Short Term Financing	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Long Term Financing	\$ 4,417,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	<b>\$ 4,417,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 80,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>d. Total Cash Outflows and Inflows (b+c)</b>	<b>\$ (22,000)</b>	<b>\$ (16,000)</b>								
<b>e. Non-Cash Expenses - Depreciation</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>	<b>\$ 231,800</b>
<b>f. Adjustments (Proceeds from)</b>										
Short Term Financing	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Long Term Financing	\$ (4,417,000)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	<b>\$ (4,417,000)</b>	<b>\$ -</b>								
<b>g. Adjusted Available Net Revenue</b>	<b>\$ (4,414,880)</b>	<b>\$ 161,320</b>	<b>\$ 168,000</b>	<b>\$ 174,850</b>	<b>\$ 181,150</b>	<b>\$ 188,430</b>	<b>\$ 196,100</b>	<b>\$ 203,970</b>	<b>\$ 211,150</b>	<b>\$ 219,550</b>
<b>h. Principal Payments on Debt</b>										
Short Term Bond/Loan Principal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Long Term Bond Principal	\$ -	\$ 159,620	\$ 166,000	\$ 172,650	\$ 179,550	\$ 186,730	\$ 194,200	\$ 201,970	\$ 210,050	\$ 218,450
Internal Loan Principal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	<b>\$ -</b>	<b>\$ 159,620</b>	<b>\$ 166,000</b>	<b>\$ 172,650</b>	<b>\$ 179,550</b>	<b>\$ 186,730</b>	<b>\$ 194,200</b>	<b>\$ 201,970</b>	<b>\$ 210,050</b>	<b>\$ 218,450</b>
<b>i. Net Cash</b>	<b>\$ 2,120</b>	<b>\$ 1,700</b>	<b>\$ 2,000</b>	<b>\$ 2,200</b>	<b>\$ 1,600</b>	<b>\$ 1,700</b>	<b>\$ 1,900</b>	<b>\$ 2,000</b>	<b>\$ 1,100</b>	<b>\$ 1,100</b>
<b>Adjusted Net Cash</b>	<b>\$ 2,120</b>	<b>\$ 1,700</b>	<b>\$ 2,000</b>	<b>\$ 2,200</b>	<b>\$ 1,600</b>	<b>\$ 1,700</b>	<b>\$ 1,900</b>	<b>\$ 2,000</b>	<b>\$ 1,100</b>	<b>\$ 1,100</b>
<b>Cash Balance (Enterprise)</b>										
Unrestricted Cash Balance	\$ 2,120	\$ 3,820	\$ 5,820	\$ 8,020	\$ 9,620	\$ 11,320	\$ 13,220	\$ 15,220	\$ 16,320	\$ 17,420
Depreciation Operating Reserve	\$ -	\$ 16,000	\$ 32,000	\$ 48,000	\$ 64,000	\$ -	\$ 16,000	\$ 32,000	\$ 48,000	\$ 64,000
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total Cash Balance</b>	<b>\$ 2,120</b>	<b>\$ 19,820</b>	<b>\$ 37,820</b>	<b>\$ 56,020</b>	<b>\$ 73,620</b>	<b>\$ 11,320</b>	<b>\$ 29,220</b>	<b>\$ 47,220</b>	<b>\$ 64,320</b>	<b>\$ 81,420</b>
<b>Debt Service (P&amp;I)</b>	<b>\$ 176,680</b>	<b>\$ 336,300</b>								
<b>Debt Service Coverage Ratio</b>	<b>\$ (23.99)</b>	<b>1.01</b>	<b>1.01</b>	<b>1.01</b>	<b>1.00</b>	<b>1.01</b>	<b>1.01</b>	<b>1.01</b>	<b>1.00</b>	<b>1.00</b>

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

**Capital Additions**

Year	1	2	3	4	5	6	7	8	9	10
<b>a. Fiber Implementation Costs</b>										
Fiber (20 year depreciation)	\$ 4,315,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Expansion Fiber (20 year depreciation)	-	-	-	-	-	-	-	-	-	-
Headend and Hub Equipment (10 year depreciation)	-	-	-	-	-	-	-	-	-	-
Headend and Hub Equipment Software (7 year depreciation)	-	-	-	-	-	-	-	-	-	-
Network Equipment (6 year depreciation)	-	-	-	-	-	-	-	-	-	-
CAI Customer Equipment (6 year depreciation)	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ 4,315,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>					
<b>b. Support Equipment (5 year depreciation unless noted)</b>										
Misc. Equipment	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Fiber Management System	-	50,000	-	-	-	-	50,000	-	-	-
Emergency Restoration Kit	-	20,000	-	-	-	-	20,000	-	-	-
Fiber OTDR and Other Tools	-	10,000	-	-	-	-	10,000	-	-	-
tbd 4	-	-	-	-	-	-	-	-	-	-
tbd 5	-	-	-	-	-	-	-	-	-	-
tbd 6	-	-	-	-	-	-	-	-	-	-
Business Development & Engineering (20 year depreciation)	-	-	-	-	-	-	-	-	-	-
Administration (7 year depreciation)	-	-	-	-	-	-	-	-	-	-
Operation and Network Equipment (7 year depreciation)	-	-	-	-	-	-	-	-	-	-
Additional Annual Capital Costs	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ 80,000</b>	<b>\$ -</b>	<b>\$ 80,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>				
<b>c. Electronics Costs (5 year depreciation)</b>										
Transport Services	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Transport Service (replacements)	-	-	-	-	-	-	-	-	-	-
Internet Service	-	-	-	-	-	-	-	-	-	-
Internet Service (replacements)	-	-	-	-	-	-	-	-	-	-
Wholesale Access	-	-	-	-	-	-	-	-	-	-
Wholesale Access (replacements)	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>d. Fiber Drop Costs (7 year depreciation - to match contract)</b>										
Transport Services	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Internet Service	-	-	-	-	-	-	-	-	-	-
Wholesale Access	-	-	-	-	-	-	-	-	-	-
Transport Replacements	-	-	-	-	-	-	-	-	-	-
Internet Replacements	-	-	-	-	-	-	-	-	-	-
Wholesale Replacements	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>Total Capital</b>	<b>\$ 4,395,000</b>	<b>\$ -</b>	<b>\$ 80,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>				

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

**Principal and Interest Payments (Year 1 Financing)**

	<b>Payment Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>Total</b>	
<b>Short Term Financing</b>													
Principal	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	
Interest		-	-	-	-	-	-	-	-	-	-	-	
Total	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	
Payment	\$	-											
Loan Amount/Balance (beginning of year)	\$	-	-	-	-	-	-	-	-	-	-	-	
Loan Amount/Balance (end of year)	\$	-	-	-	-	-	-	-	-	-	-	-	
Payment Start		3											
Term (years)		10											
Interest		6.00%											
<b>Long Term Financing</b>													
Principal	\$	-	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Interest		176,680		176,680		170,300		163,650		156,750		149,570	
Total	\$	176,680		\$	\$	\$	\$	\$	\$	\$	\$	\$	
Payment	\$	336,300											
Loan Amount/Balance (beginning of year)	\$	4,417,000		4,417,000		4,257,380		4,091,380		3,918,730		3,739,180	
Loan Amount/Balance (end of year)	\$	4,417,000		4,257,380		4,091,380		3,918,730		3,739,180		3,552,450	
Payment Start		2											
Term (years)		20											
Interest		4.00%											
<b>Internal Loan</b>													
Principal	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	
Interest		-	-	-	-	-	-	-	-	-	-	-	
Total	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	
Payment	\$	-											
Loan Amount/Balance (beginning of year)	\$	-	-	-	-	-	-	-	-	-	-	-	
Loan Amount/Balance (end of year)	\$	-	-	-	-	-	-	-	-	-	-	-	
Payment Start		2											
Term (years)		10											
Interest		3.00%											
<b>Total</b>													
Principal	\$	-	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Interest		176,680		176,680		170,300		163,650		156,750		149,570	
Total	\$	176,680		\$	\$	\$	\$	\$	\$	\$	\$	\$	
<b>Total (all years)</b>													
Principal	\$	-	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Interest		176,680		176,680		170,300		163,650		156,750		149,570	
Total	\$	176,680		\$	\$	\$	\$	\$	\$	\$	\$	\$	

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

**Depreciation**

	<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
30 Year Capital Expenditures	\$	-	\$	-	\$	-	\$	-	\$	-	\$
		4,315,000									
20 Year Capital Expenditures		-	-	-	-	-	-	-	-	-	-
10 Year Capital Expenditures		-	-	-	-	-	-	-	-	-	-
7 Year Capital Expenditures		-	-	-	-	-	-	-	-	-	-
6 Year Capital Expenditures		-	-	-	-	-	-	-	-	-	-
5 Year Capital Expenditures		80,000	-	-	-	-	80,000	-	-	-	-
Total	\$	4,395,000	\$	-	\$	-	\$	80,000	\$	-	\$
Depreciation Total	<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
	\$	231,800	\$	231,800	\$	231,800	\$	231,800	\$	231,800	\$

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

#### Expenses

Year	1	2	3	4	5	6	7	8	9	10
Operating Expenses										
Operating & Maintenance Expenses										
Locates & Ticket Processing	\$ 2,800	\$ 11,320	\$ 11,550	\$ 11,780	\$ 12,010	\$ 12,250	\$ 12,500	\$ 12,750	\$ 13,000	\$ 13,260
Network Connections and Splices (Dark Fiber)	-	-	-	-	-	-	-	-	-	-
DIA (Internal Use)	-	-	-	-	-	-	-	-	-	-
Annual License Fee - Wireless AP's	-	-	-	-	-	-	-	-	-	-
Insurance (liability)	5,000	10,200	10,400	10,610	10,820	11,040	11,260	11,490	11,720	11,950
Office Expense	-	-	-	-	-	-	-	-	-	-
Legal	-	-	-	-	-	-	-	-	-	-
Annual Vendor Maintenance & Licensing Fee										
Fiber Maintenance (breaks and other)	21,700	44,370	45,260	46,160	47,080	48,020	48,990	49,960	50,960	51,980
Sales & Marketing	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
Broker Commissions (IRU)	-	-	-	-	-	-	-	-	-	-
Broker Commissions (Lease and Maintenance Payments)	-	-	-	-	-	-	-	-	-	-
Legal & Other Support	20,000	-	-	-	-	-	-	-	-	-
Economic Development Credits	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
Fiber Maintenance	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
Contingency	5,000	10,200	10,400	10,610	10,820	11,040	11,260	11,490	11,720	11,950
Total	\$ 54,500	\$ 76,090	\$ 77,610	\$ 79,160	\$ 80,730	\$ 82,350	\$ 84,010	\$ 85,690	\$ 87,400	\$ 89,140
Operating Expenses - Training, Attachments, Utilities										
Attachment Fees	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Education and Training	-	-	-	-	-	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-	-	-	-	-	-
Churn	-	-	-	-	-	-	-	-	-	-
Tier 1 to Tier 3 Support (internet)	-	-	-	-	-	-	-	-	-	-
Tier 1 to Tier 3 Support (transport)	-	-	-	-	-	-	-	-	-	-
Customer Acquisition Costs	-	-	-	-	-	-	-	-	-	-
DIA for Customers (seperate from transport)	-	-	-	-	-	-	-	-	-	-
Utilities	-	-	-	-	-	-	-	-	-	-
Long Term Lease	-	-	-	-	-	-	-	-	-	-
Total	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Salaries										
Salaries (Base 3)										
Business Manager	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Fiber Plant O&M Technicians	-	-	-	-	-	-	-	-	-	-
Network Engineer	-	-	-	-	-	-	-	-	-	-
Fiber Engineer	-	-	-	-	-	-	-	-	-	-
Customer Service Representative/Help Desk	-	-	-	-	-	-	-	-	-	-
Service Technicians/Installers	-	-	-	-	-	-	-	-	-	-
Sales and Marketing Representative	-	-	-	-	-	-	-	-	-	-
Optic Engineer	-	-	-	-	-	-	-	-	-	-
Sales and Marketing Representative	-	-	-	-	-	-	-	-	-	-
Helpdesk	-	-	-	-	-	-	-	-	-	-
Contract Management	-	-	-	-	-	-	-	-	-	-
GIS Support	5,700	5,900	6,100	6,300	6,400	6,600	6,800	7,000	7,200	7,500
HR and Accounting Support	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Staff	\$ 5,700	\$ 5,900	\$ 6,100	\$ 6,300	\$ 6,400	\$ 6,600	\$ 6,800	\$ 7,000	\$ 7,200	\$ 7,500
Total w/o Adjustments and Payments	\$ 60,200	\$ 81,990	\$ 83,710	\$ 85,460	\$ 87,130	\$ 88,950	\$ 90,810	\$ 92,690	\$ 94,600	\$ 96,640

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**  
**May 19, 2019**

**Revenues - Site Based**

	<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
Transport Services											
Facility Sites		-	-	-	-	-	-	-	-	-	-
SCADA Sites		-	-	-	-	-	-	-	-	-	-
Access (total)	261,000	\$ 436,000	\$ 438,000	\$ 440,000	\$ 441,000	\$ 443,000	\$ 445,000	\$ 447,000	\$ 448,000	\$ 450,000	
W TBD 4	-	-	-	-	-	-	-	-	-	-	-
W TBD 5	-	-	-	-	-	-	-	-	-	-	-
W TBD 6	-	-	-	-	-	-	-	-	-	-	-
W TBD 7	-	-	-	-	-	-	-	-	-	-	-
W TBD 8	-	-	-	-	-	-	-	-	-	-	-
W TBD 9	-	-	-	-	-	-	-	-	-	-	-
W TBD 10	-	-	-	-	-	-	-	-	-	-	-
W TBD 11	-	-	-	-	-	-	-	-	-	-	-
W TBD 12	-	-	-	-	-	-	-	-	-	-	-
W TBD 13	-	-	-	-	-	-	-	-	-	-	-
W TBD 14	-	-	-	-	-	-	-	-	-	-	-
W TBD 15	-	-	-	-	-	-	-	-	-	-	-
Total	\$ 261,000	\$ 436,000	\$ 438,000	\$ 440,000	\$ 441,000	\$ 443,000	\$ 445,000	\$ 447,000	\$ 448,000	\$ 450,000	
Total	\$ 261,000	\$ 436,000	\$ 438,000	\$ 440,000	\$ 441,000	\$ 443,000	\$ 445,000	\$ 447,000	\$ 448,000	\$ 450,000	

**Wildwood MO**  
**Middle Mile Fiber - Dark**  
**Rev 2**

**OSP Cost Estimate**

	Backbone	tbd	tbd
Engineering	\$ 1,233,000	\$ -	\$ -
Project Management / Quality Assurance	654,000	-	-
General Outside Plant Construction	2,202,000	-	-
Railroad, Bridge, and Interstate Crossings	-	-	-
Outside Plant Fiber Splicing	45,000	-	-
Fiber Termination / Building "Entrance"	<u>181,000</u>	-	-
Total	\$ 4,315,000	\$ -	\$ -

Core/Distribution Electronics	\$ -	\$ -	\$ -
Edge Site Electronics	-	-	-
	\$ -	\$ -	\$ -

Total Sites

Facility	-	-	-
SCADA	-	-	-
	-	-	-

Total Miles

Underground	23.19	-	-
Overhead	<u>92.78</u>	-	-
	<u>115.97</u>	-	-

Electronic Per Site (average)

Facility	\$ -	
SCADA	\$ -	-

used to calculate T

tbd	tbd	Total
\$ -	\$ -	\$ 1,233,000
-	-	654,000
-	-	2,202,000
-	-	-
-	-	45,000
-	-	181,000
<hr/>	<hr/>	<hr/>
\$ -	\$ -	\$ 4,315,000

\$ -	\$ -	\$ -	Match to site numbers
<hr/>	<hr/>	<hr/>	<hr/>
\$ -	\$ -	\$ -	-

- -	- -	23.19
- -	- -	92.78
<hr/>	<hr/>	<hr/>
- -	- -	115.97

tier 1 support for facility sites

## Assumptions

## ***Page Title Information***

---

Organization  
Plan Name

Location  
Date

## ***Financial Assumptions***

## **Finance Requirements**

Beginning Cash	\$	-		Year	1	2	3	4	5	6	7	8	9	10							
Short Term Financing	\$	-	\$																		
Long Term Financing																					
Internal Loan																					
Total	\$	4,417,000	\$																		
Shortage	\$	22,000	\$																		
Capital Additions	\$	4,395,000	\$																		
				Year	1	2	3	4	5	6	7	8	9	10							
Depreciation Reserve Funding					0.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%							
Capital Expenditure Funded by Depreciation Reserve					0.00%	0.00%	0.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%							
Unrestricted Cash Balance	\$	2,120	\$		3,820	\$	5,820	\$	8,020	\$	9,620	\$	11,320	\$	13,220	\$	15,220	\$	16,320	\$	17,420
Depreciation Operating Reserve	\$	-	\$		16,000	\$	32,000	\$	48,000	\$	64,000	\$	-	\$	16,000	\$	32,000	\$	48,000	\$	64,000
Debt Service Reserve	\$	-	\$		-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Total Cash Balance	\$	2,120	\$		19,820	\$	37,820	\$	56,020	\$	73,620	\$	11,320	\$	29,220	\$	47,220	\$	64,320	\$	81,420

### Short Term Financing

Finance Rate	6.00%	6.00%	6.00%	6.00%	6.00%	
Period (years)	10	10	10	7	7	
Principal Repayment Period Start	3	2	2	1	1	
Issuance Cost	1.00%	1.00%	1.00%	1.00%	1.00%	
Debt Service Reserve	0.00%	0.00%	0.00%	0.00%	0.00%	
Interest Reserve	no	no	no	no	no	
Interest Reserve Year 1 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 2 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 3 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 4 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 5 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Total	\$ - \$	- \$	- \$	- \$	- \$	- \$

### Long Term Financing

	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Period (years)	20	20	20	20	20	
Principal Repayment Period Start	2	3	4	5	6	
Bond Issuance Cost	1.00%	1.00%	1.00%	1.00%	1.00%	
Debt Service Reserve	0.00%	0.00%	0.00%	0.00%	0.00%	
Interest Reserve	no	no	no	no	no	
Interest Reserve Year 1 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 2 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 3 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 4 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Interest Reserve Year 5 Financing	\$ - \$	- \$	- \$	- \$	- \$	
Total	\$ - \$	- \$	- \$	- \$	- \$	- \$

### Internal Loan

Finance Rate	3.00%	3.00%	3.00%	3.00%	3.00%	
Period (Years)	10	3	3	3	3	
Principal Repayment Period Start	2	2	2	1	1	

### Other

Investment Income	\$ - \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$
Interest Earned on Available Cash	0.25%	Linked to previous year cash balance				Use one or the other, but not both						

## *Customer Assumptions*

### Transport Services

	1	2	3	4	5	6	7	8	9	10
Transport Services	Year									
Facility Sites	-	-	-	-	-	-	-	-	-	-
SCADA Sites	-	-	-	-	-	-	-	-	-	-
Access (total)	1	-	-	-	-	-	-	-	-	-
W TBD 4	-	-	-	-	-	-	-	-	-	-
W TBD 5	-	-	-	-	-	-	-	-	-	-
W TBD 6	-	-	-	-	-	-	-	-	-	-
W TBD 7	-	-	-	-	-	-	-	-	-	-
W TBD 8	-	-	-	-	-	-	-	-	-	-
W TBD 9	-	-	-	-	-	-	-	-	-	-
W TBD 10	-	-	-	-	-	-	-	-	-	-
W TBD 11	-	-	-	-	-	-	-	-	-	-
W TBD 12	-	-	-	-	-	-	-	-	-	-
W TBD 13	-	-	-	-	-	-	-	-	-	-
W TBD 14	-	-	-	-	-	-	-	-	-	-
W TBD 15	-	-	-	-	-	-	-	-	-	-
Total	1	-	-	-	-	-	-	-	-	-

	1	2	3	4	5	6	7	8	9	10
Transport Services	Year									
Facility Sites	-	-	-	-	-	-	-	-	-	-
SCADA Sites	-	-	-	-	-	-	-	-	-	-
Access (total)	1	1	1	1	1	1	1	1	1	1
W TBD 4	-	-	-	-	-	-	-	-	-	-
W TBD 5	-	-	-	-	-	-	-	-	-	-
W TBD 6	-	-	-	-	-	-	-	-	-	-
W TBD 7	-	-	-	-	-	-	-	-	-	-
W TBD 8	-	-	-	-	-	-	-	-	-	-
W TBD 9	-	-	-	-	-	-	-	-	-	-
W TBD 10	-	-	-	-	-	-	-	-	-	-
W TBD 11	-	-	-	-	-	-	-	-	-	-
W TBD 12	-	-	-	-	-	-	-	-	-	-
W TBD 13	-	-	-	-	-	-	-	-	-	-
W TBD 14	-	-	-	-	-	-	-	-	-	-
W TBD 15	-	-	-	-	-	-	-	-	-	-
Total	1	1	1	1	1	1	1	1	1	1



## Revenue Assumptions

### Transport Services

Inflation Transport Services

	0.40%	1.00	1.004	1.008	1.012	1.016	1.0201	1.0242	1.0283	1.0324	1.0365
		1	2	3	4	5	6	7	8	9	10
Year											
Transport Services											
Facility Sites		60.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
SCADA Sites		60.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Access (total)		60.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 4		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 5		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 6		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 7		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 8		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 9		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 10		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 11		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 12		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 13		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 14		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
W TBD 15		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Multiplier (to account for customer ramp-up) Match to Deployment											
Facility Sites		-	-	-	-	-	-	-	-	-	-
SCADA Sites		-	-	-	-	-	-	-	-	-	-
Access (total)		36,200.00	36,340	36,490	36,630	36,780	36,930	37,080	37,220	37,370	37,520
W TBD 4		-	-	-	-	-	-	-	-	-	-
W TBD 5		-	-	-	-	-	-	-	-	-	-
W TBD 6		-	-	-	-	-	-	-	-	-	-
W TBD 7		-	-	-	-	-	-	-	-	-	-
W TBD 8		-	-	-	-	-	-	-	-	-	-
W TBD 9		-	-	-	-	-	-	-	-	-	-
W TBD 10		-	-	-	-	-	-	-	-	-	-
W TBD 11		-	-	-	-	-	-	-	-	-	-
W TBD 12		-	-	-	-	-	-	-	-	-	-
W TBD 13		-	-	-	-	-	-	-	-	-	-
W TBD 14		-	-	-	-	-	-	-	-	-	-
W TBD 15		-	-	-	-	-	-	-	-	-	-
Monthly Fee (per service)											
Facility Sites		-	-	-	-	-	-	-	-	-	-
SCADA Sites		-	-	-	-	-	-	-	-	-	-
Access (total)		36,200.00	36,340	36,490	36,630	36,780	36,930	37,080	37,220	37,370	37,520
W TBD 4		-	-	-	-	-	-	-	-	-	-
W TBD 5		-	-	-	-	-	-	-	-	-	-
W TBD 6		-	-	-	-	-	-	-	-	-	-
W TBD 7		-	-	-	-	-	-	-	-	-	-
W TBD 8		-	-	-	-	-	-	-	-	-	-
W TBD 9		-	-	-	-	-	-	-	-	-	-
W TBD 10		-	-	-	-	-	-	-	-	-	-
W TBD 11		-	-	-	-	-	-	-	-	-	-
W TBD 12		-	-	-	-	-	-	-	-	-	-
W TBD 13		-	-	-	-	-	-	-	-	-	-
W TBD 14		-	-	-	-	-	-	-	-	-	-
W TBD 15		-	-	-	-	-	-	-	-	-	-
Weighted Monthly Fee											
Facility Sites		-	-	-	-	-	-	-	-	-	-
SCADA Sites		-	-	-	-	-	-	-	-	-	-
Access (total)		21,720	36,340	36,490	36,630	36,780	36,930	37,080	37,220	37,370	37,520
W TBD 4		-	-	-	-	-	-	-	-	-	-
W TBD 5		-	-	-	-	-	-	-	-	-	-
W TBD 6		-	-	-	-	-	-	-	-	-	-
W TBD 7		-	-	-	-	-	-	-	-	-	-
W TBD 8		-	-	-	-	-	-	-	-	-	-
W TBD 9		-	-	-	-	-	-	-	-	-	-
W TBD 10		-	-	-	-	-	-	-	-	-	-
W TBD 11		-	-	-	-	-	-	-	-	-	-
W TBD 12		-	-	-	-	-	-	-	-	-	-
W TBD 13		-	-	-	-	-	-	-	-	-	-
W TBD 14		-	-	-	-	-	-	-	-	-	-
W TBD 15		-	-	-	-	-	-	-	-	-	-



## Operation & Maintenance Expense Assumptions

### Taxes

Dark Fiber & IRU Taxes

City and State Taxes (applied to site based revenues)

Sales tax is a pass through expense

0.00%

0.0000%

State 0.0000%

County 0.0000%

City 0.0000%

### Operating & Maintenance Expenses

	1	2	3	4	5	6	7	8	9	10
Locates & Ticket Processing	\$ 2,800	\$ 11,100	\$ 11,100	\$ 11,100	\$ 11,100	\$ 11,100	\$ 11,100	\$ 11,100	\$ 11,100	\$ 11,100
Network Connections and Splices (Dark Fiber)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
DIA (Internal Use)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Annual License Fee - Wireless AP's	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Insurance (liability)	\$ 5,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000
Office Expense	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Legal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Annual Vendor Maintenance & Licensing Fee	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Fiber Maintenance (breaks and other)	\$ 21,700	\$ 43,500	\$ 43,500	\$ 43,500	\$ 43,500	\$ 43,500	\$ 43,500	\$ 43,500	\$ 43,500	\$ 43,500
Sales & Marketing	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
tbd	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Broker Commissions (IRU)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Broker Commissions (Lease and Maintenance Payments)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Legal & Other Support	\$ 20,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Economic Development Credits	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
tbd	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
tbd	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Fiber Maintenance	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
tbd	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
tbd	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Contingency	\$ 5,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000
Inflation	2.00%	applied on "Expense" sheet								

### Operating Expenses - Training, Attachments, Utilities

Education and Training 0.00% percent of total labor expense

Allowance for Bad Debts 0.00% of Internet and Transport services

Churn 0.00% per year 3 times acquisition costs

Tier 1 to Tier 3 Support (internet) \$ - per month per Internet Customer

Tier 1 to Tier 3 Support (transport) \$ - \$ - month per Facility customer

Customer Acquisition Costs \$ - per Internet Customer

Customer Acquisition Costs \$ - per Transport Customer

	1	2	3	4	5	6	7	8	9	10
DIA Sales (Mbps) (for transport customers)	0	0	0	0	0	0	0	0	0	0
DIA Sell price	\$ 2.00	per Mbps per month								

DIA for Customers (seperate from transport)

	1	2	3	4	5	6	7	8	9	10
DIA for Customers (seperate from transport)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

DIA for Internet Services

per Mbps per month	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50
oversubscription ratio	25	25	25	25	25	25	25	25	25	25

Internal DIA Use

Mbps Available for Internal (total)	-	-	-	-	-	-	-	-	-	-
per Mbps per month	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50	\$ 1.50
Total Cost Annual	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

	1	2	3	4	5	6	7	8	9	10
Total BW used internally (Mbps)	-	-	-	-	-	-	-	-	-	-
Available BW to apply to other users	-	-	-	-	-	-	-	-	-	-
Needed for other users	-	-	-	-	-	-	-	-	-	-
Net required for other users	-	-	-	-	-	-	-	-	-	-
Attachment Fees		3,248 poles at	\$	-	per year	3,248 poles	100.00%	subject to fee	150 Average Span (feet)	
Utilities	\$	1	2	\$	3	\$	4	\$	5	\$
									92.78 Miles - Aerial	

### Annual Expense Escalations

Salaries	3.00%	
Overhead	35.00% of base salary	0% if inputed numbers include overhead

### Labor Expense (Calculation Base 3)

Incremental Employees	List FTE's			Labor Cost (with overhead)	115.97 route miles	0 Tech per	100 route mile
	Year 1	Year 2	Year 3+				
Business Manager	-	-	-	85,000			
Fiber Plant O&M Technicians	-	-	-	95,000			
Network Engineer	-	-	-	-			
Fiber Engineer	-	-	-	-			
Customer Service Representative/Help Desk	-	-	-	60,000	2500	1	
Service Technicians/Installers	-	-	-	70,000	1	1	
Sales and Marketing Representative	-	-	-	-		10	CSR's per sales person
Optic Engineer	-	-	-	-			
Sales and Marketing Representative	-	-	-	-			
Helpdesk	-	-	-	-			
Contract Management	-	-	-	-			
GIS Support	0.05	0.05	0.05	85,000			
HR and Accounting Support	-	-	-	-			
Total Staff	0.05	0.05	0.05				

### Capital Requirement Assumptions

Miscellaneous Costs	0						
Misc. Equipment	\$ -	\$ -	\$ -	\$ -	100%	year 6	
Fiber Management System	\$ 50,000	\$ -	\$ -	\$ -	100%	year 6	
Emergency Restoration Kit	\$ 20,000	\$ -	\$ -	\$ -	100%	year 6	
Fiber OTDR and Other Tools	\$ 10,000	\$ -	\$ -	\$ -	100%	year 6	
tbd 4	\$ -	\$ -	\$ -	\$ -	100%	year 6	
tbd 5	\$ -	\$ -	\$ -	\$ -	100%	year 6	
tbd 6	\$ -	\$ -	\$ -	\$ -	100%	year 8	
Additional Annual Capital Costs	0.00%	Percent of Year 1 to Year 3 fiber implementation costs		Starts in year	4		

### Implementation Costs

OSP & Network Electronics	1	2	3	4	Year 1 Build	Year 2 Build	Total
Fiber (20 year depreciation)	\$ 4,315,000	\$ -	\$ -	\$ -	100%	0%	\$ 4,315,000
Headend and Hub Equipment (10 year depreciation)	\$ -	\$ -	\$ -	\$ -	100%	0%	\$ -
Headend and Hub Equipment Software (7 year depreciation)	\$ -	\$ -	\$ -	\$ -	100%	0%	\$ -
Network Equipment (6 year depreciation)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
CAI Customer Equipment (6 year depreciation)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	CAI Capital Contribution? no Original no
TBD							
Fiber (20 year depreciation)	\$ -	\$ -	\$ -	\$ -	100%	0%	\$ -
Headend and Hub Equipment (10 year depreciation)	\$ -	\$ -	\$ -	\$ -	100%	0%	\$ -
Headend and Hub Equipment Software (7 year depreciation)	\$ -	\$ -	\$ -	\$ -	100%	0%	\$ -
Network Equipment (6 year depreciation)	\$ -	\$ -	\$ -	\$ -	40%	45%	\$ -
CAI Customer Equipment (6 year depreciation)	\$ -	\$ -	\$ -	\$ -	40%	45%	\$ -
TBD							
Fiber (20 year depreciation)	\$ -	\$ -	\$ -	\$ -	100%	0%	\$ -
Headend and Hub Equipment (10 year depreciation)	\$ -	\$ -	\$ -	\$ -	40%	45%	\$ -
Headend and Hub Equipment Software (7 year depreciation)	\$ -	\$ -	\$ -	\$ -	40%	45%	\$ -
Network Equipment (6 year depreciation)	\$ -	\$ -	\$ -	\$ -	40%	45%	\$ -
CAI Customer Equipment (6 year depreciation)	\$ -	\$ -	\$ -	\$ -	40%	45%	\$ -

Total Network

Replacement

Fiber (20 year depreciation)	\$ 4,315,000	\$ -	\$ -	\$ -										
Headend and Hub Equipment (10 year depreciation)	-	-	-	-										100% Year 11
Headend and Hub Equipment Software (7 year depreciation)	-	-	-	-										100% year 8
Network Equipment (6 year depreciation)	-	-	-	-										100% year 8
CAI Customer Equipment (6 year depreciation)	-	-	-	-										100% year 8
Business Development & Support Engineering	<u>\$ 4,315,000</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>										

Other Misc.	1	2	3	4	5	6	7	8	9	10
Administration	\$ -	\$ -	\$ -	na						
Operation and Network Equipment	\$ -	\$ -	\$ -	na						
Expansion Fiber (20 year depreciation)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

Fiber (Accrued)	\$ 4,315,000	\$ 4,315,000	\$ 4,315,000
Network Equipment (Accrued)	\$ -	\$ -	\$ -
Business Development & Support (Accrued)	\$ -	\$ -	\$ 4,315,000

#### Real Estate

Interconnection Sites	\$ -	\$ -	\$ -
Real Estate (20 year depreciation)	\$ -	\$ -	\$ -

#### Long Term Lease

\$ -	\$ -	\$ -	per year
			per year
			per year
			per year
Long Term Lease	\$ -	\$ -	Treat as capital? yes

#### Wireless

Microwave (10 year)	\$ -	\$ -	\$ -		
Structures (20 year)	\$ -	\$ -	\$ -		
Access (10 year)	\$ -	\$ -	\$ -		
Network Equipment (7 year)	\$ -	\$ -	\$ -		
Spare Equipment (7 year)	\$ -	\$ -	\$ -		
Installation & Engineering (7 year)	\$ -	\$ -	\$ -		
Total	\$ -	\$ -	\$ -		
Accrued	\$ -	\$ -	\$ -		
				100% year 8	
				100% year 8	
				125% year 8	

### Fiber Drop Costs

Transport Services	\$ -	50.00%		25.00%	\$ -
Internet Service	\$ -	25.00%	Replacement Costs	5.00%	Customer Charge \$ -
Wholesale Access	\$ -	60.00%		100.00%	\$ -

		Incremental Additions by Year									
		1	2	3	4	5	6	7	8	9	10
Transport Services		1	-	-	-	-	-	-	-	-	-
Internet Service		-	-	-	-	-	-	-	-	-	-
Wholesale Access		-	-	-	-	-	-	-	-	-	-
Transport Services		-	-	-	-	-	-	-	-	-	-
Internet Service		-	-	-	-	-	-	-	-	-	-
Wholesale Access		-	-	-	-	-	-	-	-	-	-

### Customer Connection Costs

Transport Services	Facility Sites	SCADA Sites	Access (total)	Total	Cost per Customer (Equipment and Installation)	1	2	3	4	5	6	7
						1	2	3	4	5	6	7
	Facility Sites	\$ -		-								
	SCADA Sites	\$ -		-								
	Access (total)	\$ -	1									
	W TBD 4	\$ -		-								
	W TBD 5	\$ -		-								
	W TBD 6	\$ -		-								
	W TBD 7	\$ -		-								
	W TBD 8	\$ -		-								
	W TBD 9	\$ -		-								
	W TBD 10	\$ -		-								
	W TBD 11	\$ -		-								
	W TBD 12	\$ -		-								
	W TBD 13	\$ -		-								
	W TBD 14	\$ -		-								
	W TBD 15	\$ -		-								
	100.00% of cost to replace when depreciated											
	0.00% recovery of costs with consumer fees											

P&I	\$ 336,300	per year
Initial Capital	\$ 4,395,000	includes test equipment
Operating Expenses	\$ 82,000	per year in year 2 (inflates ea
Required Revenues	\$ 434,400	per year in year 2 (inflates ea
Required Revenues - less P&I (includes depreciation reserv	\$ 98,100	
Depreciation Reserve	\$ (16,000)	
Net	\$ 82,100	
Delta to Expenses	\$ 100	

ach year - rate lower than expenses)

## **Appendix D: Dark FTTP Financial Model**

The full working model is supplied as a separate document.

**Wildwood MO  
Dark FTTP  
Low Density Build  
Westminster Model - Rev 3  
May 19, 2019**

First is to ensure that all assumptions are clearly understood and their impact to the projected results. Second is to present a plausible outcome of the proposed broadband business. Third is to provide a guide to judge the progress of the broadband business as it unfolds. CTC does not warrant the analysis, the assumptions, or the success of the broadband business. CTC only offers this tool as a means of providing consultative advice. There will usually be differences between the projected and actual results, because events and circumstances frequently do not occur as expected, and those differences may be material.

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

	Page
<b>Financial Statements</b>	
Income Statement	3
Cash Flow Statement	5
Capital Additions	7
Bond Summary	16
Operation and Maintenance Expenses	17
<b>FTTP Cost Summary</b>	
Outside Plant (OSP) Cost Estimate Summary (with contingency)	12
Network Electronics Summary	13
<b>Other</b>	
Project Assumptions	14

**Wildwood MO  
Dark FTTP  
Low Density Build  
Westminster Model - Rev 3  
May 19, 2019**

## **Income Statement**

Legal & Consulting	50,000	10,200	10,400	10,600	10,800	11,020	11,240	11,460	11,690	11,920
Planning	-	-	-	-	-	-	-	-	-	-
Consulting	-	-	-	-	-	-	-	-	-	-
Marketing	-	-	-	-	-	-	-	-	-	-
Education and Training	4,660	4,210	4,330	4,450	4,570	4,710	4,850	5,000	5,150	5,300
Customer Handholding	-	-	-	-	-	-	-	-	-	-
Customer Billing (Unit)	-	-	-	-	-	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-	-	-	-	-	-
Churn (acquisition costs)	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
CLEC Cerification	-	-	-	-	-	-	-	-	-	-
PSTN Connection Fee	-	-	-	-	-	-	-	-	-	-
Low Income Assistance	-	-	-	-	-	-	-	-	-	-
Pole Attachment Expense	2,600	9,730	16,230	18,380	18,730	19,070	19,420	19,770	20,110	20,460
<b>Total</b>	<b>\$ 336,390</b>	<b>\$ 368,040</b>	<b>\$ 455,000</b>	<b>\$ 467,600</b>	<b>\$ 478,380</b>	<b>\$ 490,250</b>	<b>\$ 502,430</b>	<b>\$ 514,920</b>	<b>\$ 527,710</b>	<b>\$ 540,820</b>
<b>d. EBITDA</b>	<b>\$ (246,450)</b>	<b>\$ 364,970</b>	<b>\$ 1,845,520</b>	<b>\$ 2,408,040</b>	<b>\$ 2,397,260</b>	<b>\$ 2,404,090</b>	<b>\$ 2,410,720</b>	<b>\$ 2,417,170</b>	<b>\$ 2,423,440</b>	<b>\$ 2,429,510</b>
<b>e. Depreciation</b>	<b>\$ 459,320</b>	<b>\$ 1,179,840</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>					
<b>f. Operating Income (EBITDA less depreciation)</b>	<b>\$ (705,770)</b>	<b>\$ (814,870)</b>	<b>\$ 377,470</b>	<b>\$ 939,990</b>	<b>\$ 929,210</b>	<b>\$ 936,040</b>	<b>\$ 942,670</b>	<b>\$ 949,120</b>	<b>\$ 955,390</b>	<b>\$ 961,460</b>
<b>g. Non-Operating Income</b>										
Interest Income	\$ -	\$ -	\$ 70	\$ 150	\$ 220	\$ 290	\$ 370	\$ (30)	\$ 40	\$ 110
Interest Expense (Bond A)	-	-	-	-	-	-	-	-	-	-
Interest Expense (Bond B)	(384,000)	(1,006,000)	(1,239,300)	(1,202,400)	(1,155,100)	(1,105,900)	(1,054,600)	(1,001,500)	(946,100)	(888,500)
Interest Expense (Loan)	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ (384,000)</b>	<b>\$ (1,006,000)</b>	<b>\$ (1,239,230)</b>	<b>\$ (1,202,250)</b>	<b>\$ (1,154,880)</b>	<b>\$ (1,105,610)</b>	<b>\$ (1,054,230)</b>	<b>\$ (1,001,530)</b>	<b>\$ (946,060)</b>	<b>\$ (888,390)</b>
<b>h. Net Income (before taxes)</b>	<b>\$ (1,089,770)</b>	<b>\$ (1,820,870)</b>	<b>\$ (861,760)</b>	<b>\$ (262,260)</b>	<b>\$ (225,670)</b>	<b>\$ (169,570)</b>	<b>\$ (111,560)</b>	<b>\$ (52,410)</b>	<b>\$ 9,330</b>	<b>\$ 73,070</b>
<b>i. City Fee</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>							
<b>j. Net Income</b>	<b>\$ (1,089,770)</b>	<b>\$ (1,820,870)</b>	<b>\$ (861,760)</b>	<b>\$ (262,260)</b>	<b>\$ (225,670)</b>	<b>\$ (169,570)</b>	<b>\$ (111,560)</b>	<b>\$ (52,410)</b>	<b>\$ 9,330</b>	<b>\$ 73,070</b>

**Wildwood MO**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

#### Income Statement

	Year	11	12	13	14	15	16	17	18	19	20
<b>a. Revenues</b>											
Video	\$	-	\$	-	\$	-	\$	-	\$	-	\$
Internet - Residential		-	-	-	-	-	-	-	-	-	-
Internet - Business		-	-	-	-	-	-	-	-	-	-
Voice		-	-	-	-	-	-	-	-	-	-
Connection Fee (net)		-	-	-	-	-	-	-	-	-	-
Per Passing		2,989,640	3,009,070	3,028,630	3,048,320	3,068,130	3,088,070	3,108,140	3,128,340	3,148,670	3,169,140
Per Customer		-	-	-	-	-	-	-	-	-	-
Special Assessment		-	-	-	-	-	-	-	-	-	-
Special Assessment Payment		-	-	-	-	-	-	-	-	-	-
Property Tax		-	-	-	-	-	-	-	-	-	-
Upfront Payment		-	-	-	-	-	-	-	-	-	-
Backbone Completion Payment		-	-	-	-	-	-	-	-	-	-
Hub Completion Payment		-	-	-	-	-	-	-	-	-	-
Fiber leases (net)		-	-	-	-	-	-	-	-	-	-
Avoided Costs (net)		-	-	-	-	-	-	-	-	-	-
Provider Fees		-	-	-	-	-	-	-	-	-	-
Passing Fees		-	-	-	-	-	-	-	-	-	-
CAF2 Funds		-	-	-	-	-	-	-	-	-	-
Increased Residential kWhr sales		-	-	-	-	-	-	-	-	-	-
Ancillary Revenues		-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$</b>	<b>2,989,640</b>	<b>\$ 3,009,070</b>	<b>\$ 3,028,630</b>	<b>\$ 3,048,320</b>	<b>\$ 3,068,130</b>	<b>\$ 3,088,070</b>	<b>\$ 3,108,140</b>	<b>\$ 3,128,340</b>	<b>\$ 3,148,670</b>	<b>\$ 3,169,140</b>
<b>b. Content Fees</b>											
Video	\$	-	\$	-	\$	-	\$	-	\$	-	\$
Internet		-	-	-	-	-	-	-	-	-	-
Voice		-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$</b>	<b>-</b>	<b>\$ -</b>								
<b>c. Operating Costs</b>											
Labor Costs	\$	273,070	\$ 281,260	\$ 289,700	\$ 298,390	\$ 307,340	\$ 316,560	\$ 326,060	\$ 335,840	\$ 345,920	\$ 356,300
Support Services		-	-	-	-	-	-	-	-	-	-
Insurance		30,400	31,010	31,630	32,260	32,910	33,570	34,240	34,920	35,620	36,330
Utilities		-	-	-	-	-	-	-	-	-	-
Office Expenses		-	-	-	-	-	-	-	-	-	-
Facility Lease		-	-	-	-	-	-	-	-	-	-
Locates & Ticket Processing		153,000	156,060	159,180	162,360	165,610	168,920	172,300	175,750	179,270	182,860
Peering (Port Charges)		-	-	-	-	-	-	-	-	-	-
Contingency		24,330	24,820	25,320	25,830	26,350	26,880	27,420	27,970	28,530	29,100
Billing Maintenance Contract		-	-	-	-	-	-	-	-	-	-
Fiber & Network Maintenance		35,060	35,760	36,480	37,210	37,950	38,710	39,480	40,270	41,080	41,900
Vendor Maintenance Contracts		-	-	-	-	-	-	-	-	-	-
Legal & Consulting		12,160	12,400	12,650	12,900	13,160	13,420	13,690	13,960	14,240	14,520

Planning	-	-	-	-	-	-	-	-	-	-	-	-	-
Consulting	-	-	-	-	-	-	-	-	-	-	-	-	-
Marketing	-	-	-	-	-	-	-	-	-	-	-	-	-
Education and Training	5,460	5,630	5,790	5,970	6,150	6,330	6,520	6,720	6,920	7,130	-	-	-
Customer Handholding	-	-	-	-	-	-	-	-	-	-	-	-	-
Customer Billing (Unit)	-	-	-	-	-	-	-	-	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-	-	-	-	-	-	-	-	-
Churn (acquisition costs)	-	-	-	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-	-	-	-
CLEC Cerification	-	-	-	-	-	-	-	-	-	-	-	-	-
PSTN Connection Fee	-	-	-	-	-	-	-	-	-	-	-	-	-
Low Income Assistance	-	-	-	-	-	-	-	-	-	-	-	-	-
Pole Attachment Expense	20,810	21,150	21,500	21,850	22,370	22,890	23,410	23,930	24,450	24,970	-	-	-
<b>Total</b>	<b>\$ 554,290</b>	<b>\$ 568,090</b>	<b>\$ 582,250</b>	<b>\$ 596,770</b>	<b>\$ 611,840</b>	<b>\$ 627,280</b>	<b>\$ 643,120</b>	<b>\$ 659,360</b>	<b>\$ 676,030</b>	<b>\$ 693,110</b>	-	-	-
<b>d. EBITDA</b>	<b>\$ 2,435,350</b>	<b>\$ 2,440,980</b>	<b>\$ 2,446,380</b>	<b>\$ 2,451,550</b>	<b>\$ 2,456,290</b>	<b>\$ 2,460,790</b>	<b>\$ 2,465,020</b>	<b>\$ 2,468,980</b>	<b>\$ 2,472,640</b>	<b>\$ 2,476,030</b>	-	-	-
<b>e. Depreciation</b>	<b>\$ 1,468,050</b>	-	-	-									
<b>f. Operating Income (EBITDA less depreciation)</b>	<b>\$ 967,300</b>	<b>\$ 972,930</b>	<b>\$ 978,330</b>	<b>\$ 983,500</b>	<b>\$ 988,240</b>	<b>\$ 992,740</b>	<b>\$ 996,970</b>	<b>\$ 1,000,930</b>	<b>\$ 1,004,590</b>	<b>\$ 1,007,980</b>	-	-	-
<b>g. Non-Operating Income</b>	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest Income	\$ 190	\$ 260	\$ 330	\$ 410	\$ 10	\$ 80	\$ 160	\$ 230	\$ 300	\$ 380	-	-	-
Interest Expense (Bond A)	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest Expense (Bond B)	(828,800)	(766,400)	(701,700)	(634,300)	(564,200)	(491,400)	(415,700)	(336,900)	(255,000)	(169,800)	-	-	-
Interest Expense (Loan)	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ (828,610)</b>	<b>\$ (766,140)</b>	<b>\$ (701,370)</b>	<b>\$ (633,890)</b>	<b>\$ (564,190)</b>	<b>\$ (491,320)</b>	<b>\$ (415,540)</b>	<b>\$ (336,670)</b>	<b>\$ (254,700)</b>	<b>\$ (169,420)</b>	-	-	-
<b>h. Net Income (before taxes)</b>	<b>\$ 138,690</b>	<b>\$ 206,790</b>	<b>\$ 276,960</b>	<b>\$ 349,610</b>	<b>\$ 424,050</b>	<b>\$ 501,420</b>	<b>\$ 581,430</b>	<b>\$ 664,260</b>	<b>\$ 749,890</b>	<b>\$ 838,560</b>	-	-	-
<b>i. City Fee</b>	<b>\$ -</b>	-	-	-									
<b>j. Net Income</b>	<b>\$ 138,690</b>	<b>\$ 206,790</b>	<b>\$ 276,960</b>	<b>\$ 349,610</b>	<b>\$ 424,050</b>	<b>\$ 501,420</b>	<b>\$ 581,430</b>	<b>\$ 664,260</b>	<b>\$ 749,890</b>	<b>\$ 838,560</b>	-	-	-

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Cash Flow Statement**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
	\$ (1,089,770)	\$ (1,820,870)	\$ (861,760)	\$ (262,260)	\$ (225,670)	\$ (169,570)	\$ (111,560)	\$ (52,410)	\$ 9,330	\$ 73,070
<b>a. Net Income</b>										
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Interest Reserve	-	-	-	-	-	-	-	-	-	-
Depreciation Reserve	-	-	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)
Patronage Reserve	-	-	-	-	-	-	-	-	-	-
Operating Reserve	-	-	-	-	-	-	-	-	-	-
Financing	(96,000)	(155,500)	(61,800)	-	-	-	-	-	-	-
Patronage Payments	-	-	-	-	-	-	-	-	-	-
Capital Expenditures	(8,835,300)	(14,410,500)	(5,764,200)	-	-	-	-	(189,000)	-	-
<b>Total</b>	<b>\$ (8,931,300)</b>	<b>\$ (14,566,000)</b>	<b>\$ (5,855,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (218,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>
<b>b. Cash Outflows</b>										
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Interest Reserve	-	-	-	-	-	-	-	-	-	-
Depreciation Reserve	-	-	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)
Patronage Reserve	-	-	-	-	-	-	-	-	-	-
Operating Reserve	-	-	-	-	-	-	-	-	-	-
Financing	(96,000)	(155,500)	(61,800)	-	-	-	-	-	-	-
Patronage Payments	-	-	-	-	-	-	-	-	-	-
Capital Expenditures	(8,835,300)	(14,410,500)	(5,764,200)	-	-	-	-	(189,000)	-	-
<b>Total</b>	<b>\$ (8,931,300)</b>	<b>\$ (14,566,000)</b>	<b>\$ (5,855,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (218,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>
<b>c. Cash Inflows</b>										
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Interest Reserve	-	-	-	-	-	-	-	-	-	-
Depreciation Reserve	-	-	-	-	-	-	-	-	189,000	-
Patronage Reserve	-	-	-	-	-	-	-	-	-	-
Investment Funds	-	-	-	-	-	-	-	-	-	-
Electric Contribution for Backbone	-	-	-	-	-	-	-	-	-	-
Grants (infrastructure)	-	-	-	-	-	-	-	-	-	-
Grants (customer premises)	-	-	-	-	-	-	-	-	-	-
Bond A Proceeds	-	-	-	-	-	-	-	-	-	-
Bond B Proceeds	9,600,000	15,550,000	6,180,000	-	-	-	-	-	-	-
Loan Proceeds	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ 9,600,000</b>	<b>\$ 15,550,000</b>	<b>\$ 6,180,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 189,000</b>	<b>\$ -</b>	<b>\$ -</b>
<b>d. Total Cash Outflows and Inflows</b>	<b>\$ 668,700</b>	<b>\$ 984,000</b>	<b>\$ 324,640</b>	<b>\$ (29,360)</b>						
<b>e. Non-Cash Expenses - Depreciation</b>	<b>\$ 459,320</b>	<b>\$ 1,179,840</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>
<b>f. Adjustments</b>										
Proceeds from Additional Cash Flows (10 Year Bond)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Proceeds from Additional Cash Flows (20 Year Bond)	\$ (9,600,000)	\$ (15,550,000)	\$ (6,180,000)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Proceeds from Additional Cash Flows (Loan)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>g. Adjusted Available Net Revenue</b>	<b>\$ (9,561,750)</b>	<b>\$ (15,207,030)</b>	<b>\$ (5,249,070)</b>	<b>\$ 1,176,430</b>	<b>\$ 1,213,020</b>	<b>\$ 1,269,120</b>	<b>\$ 1,327,130</b>	<b>\$ 1,386,280</b>	<b>\$ 1,448,020</b>	<b>\$ 1,511,760</b>
<b>h. Principal Payments on Debt</b>										
10 Year Bond Principal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
20 Year Bond Principal	-	346,900	922,800	1,183,000	1,230,300	1,279,500	1,330,800	1,383,900	1,439,300	1,496,900
Loan Principal	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ -</b>	<b>\$ 346,900</b>	<b>\$ 922,800</b>	<b>\$ 1,183,000</b>	<b>\$ 1,230,300</b>	<b>\$ 1,279,500</b>	<b>\$ 1,330,800</b>	<b>\$ 1,383,900</b>	<b>\$ 1,439,300</b>	<b>\$ 1,496,900</b>
<b>i. Net Cash</b>	<b>\$ 38,250</b>	<b>\$ (3,930)</b>	<b>\$ 8,130</b>	<b>\$ (6,570)</b>	<b>\$ (17,280)</b>	<b>\$ (10,380)</b>	<b>\$ (3,670)</b>	<b>\$ 2,380</b>	<b>\$ 8,720</b>	<b>\$ 14,860</b>

**j. Cash Balance**

Unrestricted Cash Balance	\$ 38,250	\$ 34,320	\$ 42,450	\$ 35,880	\$ 18,600	\$ 8,220	\$ 4,550	\$ 6,930	\$ 15,650	\$ 30,510
Depreciation Reserve	-	-	29,360	58,720	88,080	117,440	146,800	(12,840)	16,520	45,880
Patronage Reserve	-	-	-	-	-	-	-	-	-	-
Operating Reserve	-	-	-	-	-	-	-	-	-	-
Interest Reserve	-	-	-	-	-	-	-	-	-	-
Debt Service Reserve	-	-	-	-	-	-	-	-	-	-
<b>Total Cash Balance</b>	<b>\$ 38,250</b>	<b>\$ 34,320</b>	<b>\$ 71,810</b>	<b>\$ 94,600</b>	<b>\$ 106,680</b>	<b>\$ 125,660</b>	<b>\$ 151,350</b>	<b>\$ (5,910)</b>	<b>\$ 32,170</b>	<b>\$ 76,390</b>
<b>Un-depreciated Value of Capital Assets</b>	<b>\$ 8,375,990</b>	<b>\$ 21,606,650</b>	<b>\$ 25,902,800</b>	<b>\$ 24,434,750</b>	<b>\$ 22,966,700</b>	<b>\$ 21,498,650</b>	<b>\$ 20,030,600</b>	<b>\$ 18,751,550</b>	<b>\$ 17,283,500</b>	<b>\$ 15,815,450</b>
<b>Debt Service Balance (10 Year Bond)</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>Debt Service Balance (20 Year Bond)</b>	<b>\$ 9,600,000</b>	<b>\$ 24,803,100</b>	<b>\$ 30,060,300</b>	<b>\$ 28,877,300</b>	<b>\$ 27,647,000</b>	<b>\$ 26,367,500</b>	<b>\$ 25,036,700</b>	<b>\$ 23,652,800</b>	<b>\$ 22,213,500</b>	<b>\$ 20,716,600</b>
<b>Debt Service Balance (Internal Loan)</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>Debt Service (P&amp;I)</b>	<b>\$ 384,000</b>	<b>\$ 1,352,900</b>	<b>\$ 2,162,100</b>	<b>\$ 2,385,400</b>						
<b>Debt Service Coverage Ratio ((Net Cash plus Total Debt Service)/Total Debt Service)</b>	1.10	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.01
<b>Debt Service Coverage Ratio (EBIDA/Total Debt Service)</b>	(0.64)	0.27	0.85	1.01	1.00	1.01	1.01	1.01	1.02	1.02

**Wildwood MO**  
**Low Density Build**  
**May 19, 2019**

**Cash Flow Statement**

	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
<b>a. Net Income</b>	\$ 138,690	\$ 206,790	\$ 276,960	\$ 349,610	\$ 424,050	\$ 501,420	\$ 581,430	\$ 664,260	\$ 749,890	\$ 838,560
<b>b. Cash Outflows</b>										
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Interest Reserve	-	-	-	-	-	-	-	-	-	-
Depreciation Reserve	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)	(29,360)
Patronage Reserve	-	-	-	-	-	-	-	-	-	-
Operating Reserve	-	-	-	-	-	-	-	-	-	-
Financing	-	-	-	-	-	-	-	-	-	-
Patronage Payments	-	-	-	-	-	-	-	-	-	-
Capital Expenditures	-	-	-	-	(189,000)	-	-	-	-	-
<b>Total</b>	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (218,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)
<b>c. Cash Inflows</b>										
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Interest Reserve	-	-	-	-	-	-	-	-	-	-
Depreciation Reserve	-	-	-	-	-	189,000	-	-	-	-
Depreciation Reserve	-	-	-	-	-	-	-	-	-	-
Investment Funds	-	-	-	-	-	-	-	-	-	-
Electric Contribution for Backbone	-	-	-	-	-	-	-	-	-	-
Grants (infrastructure)	-	-	-	-	-	-	-	-	-	-
Grants (customer premises)	-	-	-	-	-	-	-	-	-	-
Bond A Proceeds	-	-	-	-	-	-	-	-	-	-
Bond B Proceeds	-	-	-	-	-	-	-	-	-	-
Loan Proceeds	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 189,000	\$ -	\$ -	\$ -	\$ -
<b>d. Total Cash Outflows and Inflows</b>	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)
<b>e. Non-Cash Expenses - Depreciation</b>	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050	\$ 1,468,050
<b>f. Adjustments</b>										
Proceeds from Additional Cash Flows (10 Year Bond)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Proceeds from Additional Cash Flows (20 Year Bond)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Proceeds from Additional Cash Flows (Loan)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>g. Adjusted Available Net Revenue</b>	\$ 1,577,380	\$ 1,645,480	\$ 1,715,650	\$ 1,788,300	\$ 1,862,740	\$ 1,940,110	\$ 2,020,120	\$ 2,102,950	\$ 2,188,580	\$ 2,277,250
<b>h. Principal Payments on Debt</b>										
10 Year Bond Principal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
20 Year Bond Principal	\$ 1,556,600	\$ 1,619,000	\$ 1,683,700	\$ 1,751,100	\$ 1,821,200	\$ 1,894,000	\$ 1,969,700	\$ 2,048,500	\$ 2,130,400	\$ 2,216,700
Loan Principal	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	\$ 1,556,600	\$ 1,619,000	\$ 1,683,700	\$ 1,751,100	\$ 1,821,200	\$ 1,894,000	\$ 1,969,700	\$ 2,048,500	\$ 2,130,400	\$ 2,216,700
<b>i. Net Cash</b>	\$ 20,780	\$ 26,480	\$ 31,950	\$ 37,200	\$ 41,540	\$ 46,110	\$ 50,420	\$ 54,450	\$ 58,180	\$ 60,550
<b>j. Cash Balance</b>										

Unrestricted Cash Balance	\$ 51,290	\$ 77,770	\$ 109,720	\$ 146,920	\$ 188,460	\$ 234,570	\$ 284,990	\$ 339,440	\$ 397,620	\$ 458,170
Depreciation Reserve	\$ 75,240	\$ 104,600	\$ 133,960	\$ 163,320	\$ 3,680	\$ 33,040	\$ 62,400	\$ 91,760	\$ 121,120	\$ 150,480
Patronage Reserve	-	-	-	-	-	-	-	-	-	-
Operating Reserve	-	-	-	-	-	-	-	-	-	-
Interest Reserve	-	-	-	-	-	-	-	-	-	-
Debt Service Reserve	-	-	-	-	-	-	-	-	-	-
<b>Total Cash Balance</b>	<b>\$ 126,530</b>	<b>\$ 182,370</b>	<b>\$ 243,680</b>	<b>\$ 310,240</b>	<b>\$ 192,140</b>	<b>\$ 267,610</b>	<b>\$ 347,390</b>	<b>\$ 431,200</b>	<b>\$ 518,740</b>	<b>\$ 608,650</b>
<b>Un-depreciated Value of Capital Assets</b>	<b>\$ 14,347,400</b>	<b>\$ 12,879,350</b>	<b>\$ 11,411,300</b>	<b>\$ 9,943,250</b>	<b>\$ 8,664,200</b>	<b>\$ 7,196,150</b>	<b>\$ 5,728,100</b>	<b>\$ 4,260,050</b>	<b>\$ 2,792,000</b>	<b>\$ 1,323,950</b>
<b>Debt Service Balance (10 Year Bond)</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>						
<b>Debt Service Balance (20 Year Bond)</b>	<b>\$ 20,716,600</b>	<b>\$ 19,160,000</b>	<b>\$ 17,541,000</b>	<b>\$ 15,857,300</b>	<b>\$ 14,106,200</b>	<b>\$ 12,285,000</b>	<b>\$ 10,391,000</b>	<b>\$ 8,421,300</b>	<b>\$ 6,372,800</b>	<b>\$ 4,242,400</b>
<b>Debt Service Balance (Internal Loan)</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>						
<b>Debt Service (P&amp;I)</b>	<b>\$ 2,385,400</b>	<b>\$ 2,385,400</b>	<b>\$ 2,385,400</b>	<b>\$ 2,386,500</b>						
<b>Debt Service Coverage Ratio ((Net Cash plus Total Debt Service)/Total Debt Service)</b>	<b>1.01</b>	<b>1.01</b>	<b>1.01</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.03</b>
<b>Debt Service Coverage Ratio (EBIDA/Total Debt Service)</b>	<b>1.02</b>	<b>1.02</b>	<b>1.03</b>	<b>1.03</b>	<b>1.03</b>	<b>1.03</b>	<b>1.03</b>	<b>1.04</b>	<b>1.04</b>	<b>1.04</b>

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Capital Additions**

	1	2	3	4	5	6	7	8	9	10	
<b>Network Equipment</b>											
Core & GPON Equipment	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Video (Resell Partner)	-	-	-	-	-	-	-	-	-	-	
Voice (Facilities-Based CLEC)	-	-	-	-	-	-	-	-	-	-	
Additional Annual Capital	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	
<b>Outside Plant and Facilities</b>											
Total Backbone and FTTP	\$ 8,646,300	\$ 14,410,500	\$ 5,764,200	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Additional Annual Capital	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>\$ 8,646,300</b>	<b>\$ 14,410,500</b>	<b>\$ 5,764,200</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	
<b>Last Mile and Customer Premises Equipment</b>											
CPE (residential and small commercial)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
CPE (medium commercial)	-	-	-	-	-	-	-	-	-	-	
CPE (enterprise)	-	-	-	-	-	-	-	-	-	-	
Average Drop Cost	-	-	-	-	-	-	-	-	-	-	
Additional Annual Replacement Capital	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	
<b>Miscellaneous Implementation Costs</b>											
OSS & Portal	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Vehicles	35,000	-	-	-	-	-	-	-	-	-	
Service Equipment	50,000	-	-	-	-	-	-	-	-	-	
Work Station, Computers, and Software	4,000	-	-	-	-	-	-	-	-	-	
Fiber OTDR and Other Tools	50,000	-	-	-	-	-	-	-	-	-	
Billing Software	-	-	-	-	-	-	-	-	-	-	
Fiber Management Software	50,000	-	-	-	-	-	-	-	-	-	
Additional Annual Capital	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>\$ 189,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	
<b>Replacement Costs for Depreciation</b>											
Network Equipment	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Last Mile and Customer Premises Equipment	-	-	-	-	-	-	-	-	-	-	
Miscellaneous Implementation Costs	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 189,000</b>	<b>\$ -</b>	
<b>Total Capital Additions</b>	<b>\$ 8,835,300</b>	<b>\$ 14,410,500</b>	<b>\$ 5,764,200</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 189,000</b>	<b>\$ -</b>	
<b>Depreciation Reserve Contribution</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 29,360</b>	<b>\$ 29,360</b>	<b>\$ 29,360</b>	<b>\$ 29,360</b>	<b>\$ 29,360</b>	<b>\$ 29,360</b>	<b>\$ 29,360</b>	<b>\$ 29,360</b>	
<b>Draws from Depreciation Reserve</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>(189,000)</b>	<b>-</b>	
<b>Net Depreciation Reserve Balance</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 29,360</b>	<b>\$ 58,720</b>	<b>\$ 88,080</b>	<b>\$ 117,440</b>	<b>\$ 146,800</b>	<b>\$ 146,800</b>	<b>\$ (12,840)</b>	<b>\$ 16,520</b>	<b>\$ 45,880</b>
<b>Cummulative Drop Investment</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	

<b>Wildwood MO</b>															\$ 176,160				
<b>Low Density Build</b>																			
<b>May 19, 2019</b>																			
<b>Capital Additions</b>																			
	<b>11</b>		<b>12</b>		<b>13</b>		<b>14</b>		<b>15</b>		<b>16</b>		<b>17</b>		<b>18</b>		<b>19</b>		<b>20</b>
<b>Network Equipment</b>	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
Core & GPON Equipment	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
Additional Annual Capital																			
<b>Total</b>	<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>
<b>Outside Plant and Facilities</b>	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
Total Backbone and FTTP	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
Additional Annual Capital																			
<b>Total</b>	<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>
<b>Last Mile and Customer Premises Equipment</b>	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
CPE (residential and small commercial)	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
CPE (medium commercial)																			
Average Drop Cost	-		-		-		-		-		-		-		-		-		-
Additional Annual Replacement Capital																			
<b>Total</b>	<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>
<b>Miscellaneous Implementation Costs</b>	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
OSS & Portal	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
Vehicles	-		-		-		-		-		-		-		-		-		-
Service Equipment	-		-		-		-		-		-		-		-		-		-
Work Station, Computers, and Software	-		-		-		-		-		-		-		-		-		-
Fiber OTDR and Other Tools	-		-		-		-		-		-		-		-		-		-
Billing Software	-		-		-		-		-		-		-		-		-		-
Additional Annual Capital																			
<b>Total</b>	<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>
<b>Replacement Costs for Depreciation</b>	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
Network Equipment	\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -		\$ -
Last Mile and Customer Premises Equipment	-		-		-		-		-		-		-		-		-		-
Miscellaneous Implementation Costs									189,000										
<b>Total</b>	<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ 189,000</b>		<b>\$ 189,000</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>
<b>Total Capital Additions</b>	<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ 189,000</b>		<b>\$ 189,000</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>		<b>\$ -</b>

	Speed (Mbps)	Oversubscription	Net
R 50	50	30	1.6667
R 100	100	30	3.3333
R Gbps	1,000	300	3.3333
tbd	250	300	0.8333
tbd	1,000	30	33.3333
B 50	50	30	1.6667
B 100	100	30	3.3333
B 1 Gbps (small commercial)	1,000	300	3.3333
B 1 Gbps (medium commercial)	1,000	200	5.0000

## Residential

## Commercial

## Total Mbps



	Year 1	Year 2	Year 3	Year 4	Year 5	
Bond B Proceeds	\$ 9,600,000	\$ 15,550,000	\$ 6,180,000	\$ -	\$ -	\$ 31,330,000
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -	0.00%
Rate	4.00%					
Term	20 years					Extend? yes
Principal Payment Start (PPS)	year 1			1	PPS index	yes needs work
Max Payment	\$ 2,385,400					
Passings	3,473					
Monthly Passing Fee (Ref)	\$ 57.24					
DSCR (Bond A)	1.40					
Adjusted Monthly Passing Fee (Ref)	\$ 80.14					
Bond Prepayment	0% of net cash of previous year (start in year 7)					
	0% of unrestricted cash balance above			\$ 1,000,000		

### Total

## **Year 1 Issue**

Bond	\$ 9,600,000	Payment	\$730,900	20 adjusted term
Rate	4.00%			
Term	20 years		-	

**Year 2 Issue**

Bond	\$ 15,550,000	Payment	\$1,184,000	20 adjusted term
Rate	4.00%			
Term	20 years	1		
		1      2      3      4      5      6      7      8      9      10     11     10		
Remaining Years	20      19      18      17      16      15      14      13      12      11     10			
Balance	15,550,000      15,550,000      14,988,000      14,403,500      13,795,600      13,163,400      12,505,900      11,822,100      11,111,000      10,371,400      9,602,300			
Payment	\$ 622,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000      \$ 1,184,000			
Interest	\$ 622,000      \$ 622,000      \$ 599,500      \$ 576,100      \$ 551,800      \$ 526,500      \$ 500,200      \$ 472,900      \$ 444,400      \$ 414,900      \$ 384,100			
Principal	\$ -      \$ 562,000      \$ 584,500      \$ 607,900      \$ 632,200      \$ 657,500      \$ 683,800      \$ 711,100      \$ 739,600      \$ 769,100      \$ 799,900			
Balance	\$ 15,550,000      \$ 14,988,000      \$ 14,403,500      \$ 13,795,600      \$ 13,163,400      \$ 12,505,900      \$ 11,822,100      \$ 11,111,000      \$ 10,371,400      \$ 9,602,300      \$ 8,802,400			
Prepayment	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Net Balance	\$ 15,550,000      \$ 14,988,000      \$ 14,403,500      \$ 13,795,600      \$ 13,163,400      \$ 12,505,900      \$ 11,822,100      \$ 11,111,000      \$ 10,371,400      \$ 9,602,300      \$ 8,802,400			
Prepayment Carry Over	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			

**Year 3 Issue**

Bond	\$ 6,180,000	Payment	\$470,500	20 adjusted term
Rate	4.00%			
Term	20 years	2		
		1      2      3      4      5      6      7      8      9      10     11		
Remaining Years	20      19      18      17      16      15      14      13      12      11			
Balance	6,180,000      6,180,000      5,956,700      5,724,500      5,483,000      5,231,800      4,970,600      4,698,900      4,416,400      4,122,600			
Payment	\$ 247,200      \$ 470,500      \$ 470,500      \$ 470,500      \$ 470,500      \$ 470,500      \$ 470,500      \$ 470,500      \$ 470,500      \$ 470,500			
Interest	\$ 247,200      \$ 247,200      \$ 238,300      \$ 229,000      \$ 219,300      \$ 209,300      \$ 198,800      \$ 188,000      \$ 176,700      \$ 164,900			
Principal	\$ -      \$ 223,300      \$ 232,200      \$ 241,500      \$ 251,200      \$ 261,200      \$ 271,700      \$ 282,500      \$ 293,800      \$ 305,600			
Balance	\$ 6,180,000      \$ 5,956,700      \$ 5,724,500      \$ 5,483,000      \$ 5,231,800      \$ 4,970,600      \$ 4,698,900      \$ 4,416,400      \$ 4,122,600      \$ 3,817,000			
Prepayment	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Net Balance	\$ 6,180,000      \$ 5,956,700      \$ 5,724,500      \$ 5,483,000      \$ 5,231,800      \$ 4,970,600      \$ 4,698,900      \$ 4,416,400      \$ 4,122,600      \$ 3,817,000			
Prepayment Carry Over	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			

**Year 4 Issue**

Bond	\$ -	Payment	\$0	20 adjusted term
Rate	4.00%			
Term	20 years	3		
		1      2      3      4      5      6      7      8      9      12		
Remaining Years	20      19      18      17      16      15      14      13      12			
Balance	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Payment	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Interest	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Principal	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Balance	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Prepayment	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Net Balance	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			
Prepayment Carry Over	\$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -      \$ -			

**Year 5 Issue**

Bond \$ -  
 Rate 4.00%  
 Term 20 years

## Payment

\$0 20 adjusted term

4

13	14	15	16	17	18	19	20	21	22	23	24	25
8	7	6	5	4	3	2	1					
\$ 17,541,000	\$ 15,857,300	\$ 14,106,200	\$ 12,285,000	\$ 10,391,000	\$ 8,421,300	\$ 6,372,800	\$ 4,242,400	\$ 2,025,700	\$ 453,600	\$ -	\$ -	\$ -
\$ 2,385,400	\$ 2,385,400	\$ 2,385,400	\$ 2,385,400	\$ 2,385,400	\$ 2,385,400	\$ 2,385,400	\$ 2,386,500	\$ 1,653,100	\$ 471,700	\$ -	\$ -	\$ 46,576,700
\$ 701,700	\$ 634,300	\$ 564,200	\$ 491,400	\$ 415,700	\$ 336,900	\$ 255,000	\$ 169,800	\$ 81,000	\$ 18,100	\$ -	\$ -	\$ 15,246,700
\$ 1,683,700	\$ 1,751,100	\$ 1,821,200	\$ 1,894,000	\$ 1,969,700	\$ 2,048,500	\$ 2,130,400	\$ 2,216,700	\$ 1,572,100	\$ 453,600	\$ -	\$ -	\$ 31,330,000
\$ 15,857,300	\$ 14,106,200	\$ 12,285,000	\$ 10,391,000	\$ 8,421,300	\$ 6,372,800	\$ 4,242,400	\$ 2,025,700	\$ 453,600	\$ -	\$ -	\$ -	\$ -
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
\$ 15,857,300	\$ 14,106,200	\$ 12,285,000	\$ 10,391,000	\$ 8,421,300	\$ 6,372,800	\$ 4,242,400	\$ 2,025,700	\$ 453,600	\$ -	\$ -	\$ -	\$ -
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
\$ 31,950	\$ 37,200	\$ 41,540	\$ 46,110	\$ 50,420	\$ 54,450	\$ 58,180	\$ 60,550					
\$ 109,720	\$ 146,920	\$ 188,460	\$ 234,570	\$ 284,990	\$ 339,440	\$ 397,620	\$ 458,170					
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -					
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -					
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -					





**Operation and Maintenance Expenses**

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>Annual Fixed Operating Expense</b>										
Insurance	\$ 15,000	\$ 25,500	\$ 26,000	\$ 26,500	\$ 27,000	\$ 27,540	\$ 28,090	\$ 28,650	\$ 29,220	\$ 29,800
Utilities	-	-	-	-	-	-	-	-	-	-
Office Expenses	-	-	-	-	-	-	-	-	-	-
Facility Lease	-	-	-	-	-	-	-	-	-	-
Locates & Ticket Processing	12,600	64,160	130,830	133,350	135,860	138,580	141,350	144,180	147,060	150,000
Peering (Port Charges)	-	-	-	-	-	-	-	-	-	-
Contingency	10,000	20,400	20,800	21,200	21,600	22,030	22,470	22,920	23,380	23,850
Billing Maintenance Contract	-	-	-	-	-	-	-	-	-	-
Fiber & Network Maintenance	8,650	23,520	29,970	30,550	31,130	31,750	32,390	33,040	33,700	34,370
Vendor Maintenance Contracts	-	-	-	-	-	-	-	-	-	-
Legal & Consulting	50,000	10,200	10,400	10,600	10,800	11,020	11,240	11,460	11,690	11,920
Planning	-	-	-	-	-	-	-	-	-	-
Consulting	-	-	-	-	-	-	-	-	-	-
Marketing	-	-	-	-	-	-	-	-	-	-
<b>Annual Variable Operating Expense (not including DIA)</b>										
Education and Training	4,660	4,210	4,330	4,450	4,570	4,710	4,850	5,000	5,150	5,300
Customer Handholding	-	-	-	-	-	-	-	-	-	-
Customer Billing (Unit)	-	-	-	-	-	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-	-	-	-	-	-
Churn (acquisition costs)	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
CLEC Certification	-	-	-	-	-	-	-	-	-	-
PSTN Connection Fee	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ 100,910</b>	<b>\$ 147,990</b>	<b>\$ 222,330</b>	<b>\$ 226,650</b>	<b>\$ 230,960</b>	<b>\$ 235,630</b>	<b>\$ 240,390</b>	<b>\$ 245,250</b>	<b>\$ 250,200</b>	<b>\$ 255,240</b>
<b>Year</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
<b>Annual Fixed Operating Expense</b>										
Insurance	\$ 30,400	\$ 31,010	\$ 31,630	\$ 32,260	\$ 32,910	\$ 33,570	\$ 34,240	\$ 34,920	\$ 35,620	\$ 36,330
Utilities	-	-	-	-	-	-	-	-	-	-
Office Expenses	-	-	-	-	-	-	-	-	-	-
Facility Lease	-	-	-	-	-	-	-	-	-	-
Locates & Ticket Processing	153,000	156,060	159,180	162,360	165,610	168,920	172,300	175,750	179,270	182,860
Peering (Port Charges)	-	-	-	-	-	-	-	-	-	-
Contingency	24,330	24,820	25,320	25,830	26,350	26,880	27,420	27,970	28,530	29,100
Billing Maintenance Contract	-	-	-	-	-	-	-	-	-	-
Fiber & Network Maintenance	35,060	35,760	36,480	37,210	37,950	38,710	39,480	40,270	41,080	41,900
Vendor Maintenance Contracts	-	-	-	-	-	-	-	-	-	-
Legal & Consulting	12,160	12,400	12,650	12,900	13,160	13,420	13,690	13,960	14,240	14,520
Planning	-	-	-	-	-	-	-	-	-	-
Consulting	-	-	-	-	-	-	-	-	-	-
Marketing	-	-	-	-	-	-	-	-	-	-
<b>Annual Variable Operating Expense (not including DIA)</b>										
Education and Training	5,460	5,630	5,790	5,970	6,150	6,330	6,520	6,720	6,920	7,130
Customer Handholding	-	-	-	-	-	-	-	-	-	-
Customer Billing (Unit)	-	-	-	-	-	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-	-	-	-	-	-
Churn (acquisition costs)	-	-	-	-	-	-	-	-	-	-
tbd	-	-	-	-	-	-	-	-	-	-
CLEC Certification	-	-	-	-	-	-	-	-	-	-
PSTN Connection Fee	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>\$ 260,410</b>	<b>\$ 265,680</b>	<b>\$ 271,050</b>	<b>\$ 276,530</b>	<b>\$ 282,130</b>	<b>\$ 287,830</b>	<b>\$ 293,650</b>	<b>\$ 299,590</b>	<b>\$ 305,660</b>	<b>\$ 311,840</b>

**Wildwood MO**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Projected Total Subscribers**

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
Total Video Customers	26	171	304	532	457	457	457	457	457	457
Total Data Customers	48	394	787	1,572	1,572	1,572	1,572	1,572	1,572	1,572
Total Voice Customers	18	159	278	480	406	331	331	331	331	331
<b>Bundling Take Rates</b>										
Minimum Number of Customers	48	394	787	1,572	1,572	1,572	1,572	1,572	1,572	1,572
Maximum Number of Customers	92	724	1,369	2,584	2,435	2,360	2,360	2,360	2,360	2,360
<b>Total Number of Customers</b>	<b>48</b>	<b>394</b>	<b>787</b>	<b>1,572</b>						
<b>New Subscribers</b>	<b>48</b>	<b>346</b>	<b>393</b>	<b>785</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Take Rate</b>	<b>1.38%</b>	<b>11.34%</b>	<b>22.66%</b>	<b>45.26%</b>						
<b>Year</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
Total Video Customers	457	457	457	457	457	457	457	457	457	457
Total Data Customers	1,572	1,572	1,572	1,572	1,572	1,572	1,572	1,572	1,572	1,572
Total Voice Customers	331	331	331	331	331	331	331	331	331	331
<b>Bundling Take Rates</b>										
Minimum Number of Customers	1,572	1,572	1,572	1,572	1,572	1,572	1,572	1,572	1,572	1,572
Maximum Number of Customers	2,360	2,360	2,360	2,360	2,360	2,360	2,360	2,360	2,360	2,360
<b>Total Number of Customers</b>	<b>1,572</b>									
<b>New Subscribers</b>	<b>-</b>									
<b>Take Rate</b>	<b>45.26%</b>									

**Total Passing** 3,473

1,244.03  
327.97

**Wildwood MO  
Dark FTTP  
Low Density Build  
Westminster Model - Rev 3  
May 19, 2019**

## **Outside Plant (OSP) Cost Estimate Summary (with contingency)**

Backbone total	612,330	feet	115.971591
Needed for Low density statnd alone	323,000	feet	
	52.75%		121588.089
Percentage adder for backhaul connection	2.00%		
Total	54.75%		

Item	Cost	Low Density	Backbone	tbd		
OSP Engineering	\$ 3,400,000	\$ 2,725,000	\$ 675,000	\$ -	\$ -	\$ 1,233,000
Quality Control/Quality Assurance	1,804,000	1,446,000	\$ 358,000	-	-	654,000
General OSP Construction Cost	22,192,000	20,986,000	\$ 1,206,000	-	-	2,202,000
Special Crossings	608,000	608,000	\$ -	-	-	-
Backbone and Distribution Plant Splicing	536,000	511,000	\$ 25,000	-	-	45,000
Backbone Hub, Termination, and Testing	281,000	182,000	\$ 99,000	-	-	181,000
FTTP Lateral Installations (see note below)	-	-	-	-	-	-
Hub Shelters	-	-	-	-	-	-
tbd	-	-	-	-	-	-
tbd	-	-	-	-	-	-
tbd	-	-	-	-	-	-
Easement Perfection	-	-	-	-	-	-
Total Estimated Outside Plant (OSP) Cost	\$ 28,821,000	\$ 26,458,000	\$ 2,363,000	\$ -	\$ -	\$ 4,315,000 37207.38817
Passing with lateral	\$ 8,299	\$ 7,618	na	na	na	
Passing without lateral	\$ 8,299	\$ 7,618	na	na	na	2,363,000

Please note the above estimate does not include the drop costs to individual residences and small businesses.

Total aerial	141.07	miles	35.00%					
Total underground	261.99	miles	65.00%					
Total	403.06	miles						
Total aerial	141.07	-	-	-	-	-	-	141.07
Total underground	261.99	-	-	-	-	-	-	261.99
	403.06	-	-	-	-	-	-	403.06
Average poles per mile	8.19	Low Density	Backbone	0	na	tbd		
Total aerial	141.07	-	-	-	-	-	-	141.07
Poles	1,156	-	-	-	-	-	-	1,156
Average span	644.33	feet		8.19	poles per mile			
Average drop cost - residential	\$ 3,959.00	\$ -						
Average drop cost - commercial	\$ 3,959.00	\$ -						
Total residential passings	3,299	3,299	-	-	-	-	-	95%
Total commercial passings	174	174	-	-	-	-	-	5%
Total	3,473	3,473	-	-	-	-	-	3,473
		Low Density	Backbone	0	tbd			
Passings				0.00%		0.00%	0.00%	0.00%
Cost				8.20%		0.00%	0.00%	
						0.00%		
Easements								0.00%
Backbone	-							
Primary Distribution	-							
		Backbone	Backbone	-		-	tbd	
Total Easement Cost	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	333.41
Cost per Easement	\$ -			Easements per mile				
				-				

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

#### Network Electronics Summary

Item	Cost		
Core Network Equipment	\$ -	\$	- if step function not used
Distribution and Access Equipment (GPON OLT)	\$ -		
Core & GPON Equipment	\$ -	\$	

| Distribution and access equipment (GPON OLT) included in the per subscriber

Annual Maintenance Fees	
Core Network Equipment	7.50%
Distribution and access equipment (GPON OLT)	5.00% see calculation below

#### Standard Residential and Business ONT and installation

Percent Increase	0.00%	applied to CPE, electronics, and OSP
ONT	\$ 280	
Demarcation Materials	\$ -	
UPS	\$ 50	
Cabling	\$ 200	
Provisioning	\$ 100	
Sub-Total	\$ 630	
OLT (average price)	\$ -	zero if step function used.
Total	\$ 630	\$ - if step function not used

#### Standard symmetrical GE Business ONT and installation

ONT	\$ 320	
Demarcation Materials	\$ 30	
UPS	\$ 50	
Cabling	\$ 200	
Provisioning	\$ 100	
Sub-Total	\$ 700	
OLT (average price)	\$ -	
Total	\$ 700	\$ -

Total Subscribers	1	2	3	4	5
Added by year	48	346	393	785	-
Cumulative	48	394	787	1,572	1,572
OLT Costs - Cumulative	\$ -	\$ -	\$ -	\$ -	\$ -
Annual Maintenance Fee (Cumulative)	\$ -	\$ -	\$ -	\$ -	\$ -
Annual Maintenance Fee (Step)	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ -	\$ -	\$ -	\$ -	\$ -

Include drops?	no
Include electronics?	no
Use GPON OLT step function?	yes
Use Core Equipment step function?	no
Community Access Model?	no

#### Distribution and Access Equipment (GPON OLT)

Take-Rate	GPON OLT	Core Electronics			
20%	\$ -	\$ -	All	3,473	
40%	\$ -	\$ -	H & M	3,473	
60%	\$ -	\$ -	L	3,473	
80%	\$ -	\$ -			
100%	\$ -	\$ -			
Take Rate	45.26%	45.26%			
Total	\$ -	\$ -			

#### Optional Equipment to Support Voice and Video Services

Video (Resell Partner)	
Antennas	\$ 200,000
Facility	\$ 12,000
Headend/servers	\$ 200,000
Total	\$ 412,000

Annual vendor maintenance fees 15% of accrued total

Voice (Facilities-Based CLEC)	
Switch	\$ 300,000
CLEC Certification and Network Facilities	\$ 150,000
Total	\$ 450,000

Annual vendor maintenance fees 10% of accrued total

Equipment	Include?			
Video (Resell Partner)	no	\$ -		
Voice (Facilities-Based CLEC)	no	\$ -	- no	\$ -

Annual Fees	
Video (Resell Partner)	\$ -
Voice (Facilities-Based CLEC)	\$ -

## Project Assumptions

### Page Title Information

Organization	Wildwood MO Dark FTTP
Plan Name	Low Density Build Westminster Model - Rev 3
Date	May 19, 2019

### Financial Assumptions

#### Bond A

Finance Rate	5.00%												
Period (Years)	15												
Principal Repayment Period Start	2												
Bond Issuance Cost	1.00% of issue												
Debt Service Reserve	0.00%												
Interest Reserve	no												
Extend Beyond Analysis Term	yes												

Set up for max of 20 years

#### Bond B

Investment Funds						
ROI					12.00%	
Period (Years)					20	
Principal Repayment Period Start					7	Set up for max of 30 years
Extend Beyond Analysis Term					no	

#### Loan

Year													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Finance Rate	5.00%	5.00%	5.00%	6.00%	7.00%								
Period (Years)	20	20	20	3	10								
Principal Repayment Start	4	3	2	1	2								

#### Other

Interest Earned on Available Cash 0.25% Calculation only applied to reserve funds.

Source of Funds	Amount Issued	Year											
		1	2	3	4	5	6	7	8	9	10	11	12
Cash flow w/o investment funds and w/startup funds	\$ (9,561,750)	\$ (15,207,030)	\$ (5,249,070)	\$ 1,176,430	\$ 1,213,020	\$ 1,269,120	\$ 1,327,130	\$ 1,386,280	\$ 1,448,020	\$ 1,511,760	\$ 1,577,380	\$ 1,645,480	
Cash flow w/o investment fund, w/startup funds, and w/o bond-loan interest	\$ (9,177,750)	\$ (14,201,030)	\$ (4,009,840)	\$ 2,378,680	\$ 2,367,900	\$ 2,374,730	\$ 2,381,360	\$ 2,387,810	\$ 2,394,080	\$ 2,400,150	\$ 2,405,990	\$ 2,411,620	
Investment payments	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Investment payments (cumulative)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Cash flow w/investment funds and w/bond-loan interest	\$ (9,561,750)	\$ (15,207,030)	\$ (5,249,070)	\$ 1,176,430	\$ 1,213,020	\$ 1,269,120	\$ 1,327,130	\$ 1,386,280	\$ 1,448,020	\$ 1,511,760	\$ 1,577,380	\$ 1,645,480	
Cash flow w/investment funds and w/o bond-loan interest	\$ (9,177,750)	\$ (14,201,030)	\$ (4,009,840)	\$ 2,378,680	\$ 2,367,900	\$ 2,374,730	\$ 2,381,360	\$ 2,387,810	\$ 2,394,080	\$ 2,400,150	\$ 2,405,990	\$ 2,411,620	
Total cash balance	\$ 38,250	\$ 34,320	\$ 71,810	\$ 94,600	\$ 106,680	\$ 125,660	\$ 151,350	\$ (5,910)	\$ 32,170	\$ 76,390	\$ 126,530	\$ 182,370	
Total cash balance (after investment payments)	\$ 38,250	\$ 34,320	\$ 71,810	\$ 94,600	\$ 106,680	\$ 125,660	\$ 151,350	\$ (5,910)	\$ 32,170	\$ 76,390	\$ 126,530	\$ 182,370	
Unrestricted cash balance (years 1 to 10) w/o investment payments	\$ 38,250	\$ 34,320	\$ 42,450	\$ 35,880	\$ 18,600	\$ 8,220	\$ 4,550	\$ 6,930	\$ 15,650	\$ 30,510	\$ 51,290	\$ 77,770	
Unrestricted cash balance (years 1 to 10) w/ investment payments	\$ 38,250	\$ 34,320	\$ 42,450	\$ 35,880	\$ 18,600	\$ 8,220	\$ 4,550	\$ 6,930	\$ 15,650	\$ 30,510	\$ 51,290	\$ 77,770	
Unrestricted cash balance (years 11 to 20) w/o investment payments	\$ 51,290	\$ 77,770	\$ 109,720	\$ 146,920	\$ 188,460	\$ 234,570	\$ 284,990	\$ 339,440	\$ 397,620	\$ 458,170			
Unrestricted cash balance (years 11 to 20) w/ investment payments	\$ 51,290	\$ 77,770	\$ 109,720	\$ 146,920	\$ 188,460	\$ 234,570	\$ 284,990	\$ 339,440	\$ 397,620	\$ 458,170			

	0.00%						20-Year			30-Year			7-Year	
		1	2	3	4	5	Calculated from cash flow w/start-up capital	Calculated from cash flow w/start-up capital and w/o interest	Calculated from cash flow w/start-up capital and w/o interest	Calculated from cash flow w/start-up capital	Calculated from cash flow w/start-up capital and w/o interest	Calculated from cash flow w/start-up capital	Calculated from cash flow w/start-up capital and w/o interest	
Investment Funds	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	IRR	-0.48%	4.21%	#VALUE!	#NUM!	#VALUE!	-37.17%	
Electric Contribution for Backbone	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	NPV	\$ (10,515,540)	491,340				\$ (23,906,000)	
Grants (infrastructure)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	Discount Rate	4.0%					(17,853,170)	
Grants (customer premises)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -								

## Project Assumptions

## Project Assumptions

### Revenues

Passing Fees											
Annual Passing Fee	\$ -	Household	100.00% Discount		100.00%	3,473 Total passings	\$ -	-	per month per passing fee (household)		
	\$ -	Business	100.00% Discount		100.00%	3,299 Household	\$ -	-	per month per passing fee (business)		
Annual Passing Fee (after discount)	\$ -	Household	0.00% Sensitivity		45.25%	174 Business					
	\$ -	Business			35.82	45.25% Take Rate (see sheet "subscribers" for effective take rate based upon bundling					
		Starts in Year	2 Can range from 1 to 6		35.65%	1.00 DSCR (Year 6)					
					100.00%	Salary index (for sensitivity analysis)					
					100.00%	Expense index (for sensitivity analysis)					

Number of Employees	Number of Businesses (InfoUSA.com Accessed June 1, 2018 )	Percent	Adjusted Number of Businesses (based design data)	Passing Fee Adjustment from Residential	Annual Fee (before discount)	Annual Fee (after discount)	Monthly Fee (before discount)	Total Annual Fee (before discount)
1 to 4	614	52.12%	90	100%	\$ -	\$ -	\$ -	\$ -
5 to 9	258	21.90%	38	100%	\$ -	\$ -	\$ -	\$ -
10 to 19	175	14.86%	26	100%	\$ -	\$ -	\$ -	\$ -
20 to 49	81	6.88%	12	100%	\$ -	\$ -	\$ -	\$ -
50 to 99	27	2.29%	4	100%	\$ -	\$ -	\$ -	\$ -
100 to 249	18	1.53%	3	100%	\$ -	\$ -	\$ -	\$ -
250 to 499	5	0.42%	1	100%	\$ -	\$ -	\$ -	\$ -
500 to 999	-	0.00%	-	100%	\$ -	\$ -	\$ -	\$ -
1,000 to 4,999	-	0.00%	-	100%	\$ -	\$ -	\$ -	\$ -
5,000 to 9,999	-	0.00%	-	100%	\$ -	\$ -	\$ -	\$ -
10,000+	-	0.00%	-	100%	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	<b>1,178</b>	<b>100.00%</b>	<b>174</b>					<b>\$ -</b>

Total Businesses in Cost estimate **174**  
from assumptions

Weighted Average Business Annual Fee (before discount) \$ -  
Linked to assumptions cell B103

	1	2	3	4	5	6	7	8	9	10
Net Annual Passing Fee (per household)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Net Annual Passing Fee (per business)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Special Assessment	3,473	passings	\$ -	per	passings	one time	\$ -	-		
Special Assessment Payment	3,473	passings	\$ -	per month per	passings	annual	\$ -	-		
Property Tax	3,473	passings	\$ -	per month per	passings	annual	\$ -	-		
	1	2	3	4	5					
Special Assessment	50.00%	50.00%	0.00%	0.00%	0.00%					
Special Assessment Payment	0.00%	25.00%	50.00%	100.00%	100.00%	Use With Bond A (alt) Only				
Property Tax	0.00%	25.00%	50.00%	100.00%	100.00%					
Special Assessment	\$ -	\$ -	\$ -	\$ -	\$ -					
Special Assessment Payment	\$ -	\$ -	\$ -	\$ -	\$ -					
Property Tax	\$ -	\$ -	\$ -	\$ -	\$ -					

Video Services	Monthly Retail Price	Content Fees	Gross Margin per Package							
Digital	\$ -	\$ -	6.00%	6.00%	Calculated from Partner Fee percentage	\$ 80.00				
			4.00%							

Internet Services	Monthly Retail Price									
Dial-up	\$ -	\$ -	100.00%	Oversubscription	Service Speed (Mbps)					
R 50	\$ -	\$ -	100.00%	30	50					
R 100	\$ -	\$ -	100.00%	30	100					
R Gbps	\$ -	\$ -	100.00%	300	1,000	\$ 60.00				
tbd	\$ -	\$ -	100.00%	300	250	\$ 85.00				
tbd	\$ -	\$ -	100.00%	30	1,000	GOG calculated from DIA				1.00
B 50	\$ -	\$ -	100.00%	30	50					
B 100	\$ -	\$ -	100.00%	30	100					
B 1 Gbps (small commercial)	\$ -	\$ -	100.00%	300	1,000					
B 1 Gbps (medium commercial)	\$ -	\$ -	100.00%	200	1,000					
1 Gbps (with SLA)	\$ -	Transport Only - No DIA								

Phone Services	Monthly Retail Price	Partner Fees	Gross Margin per Package							
Unlimited Local Calling	\$ -	80%	\$ -							
Unlimited Local and Long Distance	\$ -	80%	\$ -	Calculated from Partner Fee percentage						
Business Package (Average)	\$ -	80%	\$ -	1 for sensitivity	\$ 20.00					

### Project Assumptions

Fees from ISP																			
Monthly Fees																			
Per Passing Per Customer Passings End of Year										Does City Get Connection Fee? Share									
\$	Year 1	\$	69.00	\$	69.00	\$	69.00	\$	69.00	\$	69.00	\$	69.00	\$	69.00	\$	7.50	\$	9.20
\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	9.20
Residential Commercial										EBITDA (yr 10 - yr 9)									
825	1,979	3,299	3,299	3,299	3,299	3,299	3,299	3,299	3,299	2,385,400	83.30%	3.00% CPI							
44	104	174	174	174	174	174	174	174	174	478,380	16.70%	0.005011349	1	\$	38,250	\$	34,320	Unrestricted c	
Total	869	2,083	3,473	3,473	3,473	3,473	3,473	3,473	3,473	2,863,780	100%								
Net Total Data Customers										Target Payment Per Passing (month)									
48	394	787	1,572	1,572	1,572	1,572	1,572	1,572	1,572	2,863,780	100%								
109	885	2,778	3,473	3,473	3,473	3,473	3,473	3,473	3,473	2,863,780	100%								
Percent	44%	45%	28%	45%	45%	45%	45%	45%	45%	68.72 LINK MANUALLY (avoids circular reference)									
End of Year Passings Passing Weighting										Comment									
25%	60%	100%	100%	100%	100%	100%	100%	100%	100%	0.00%	1	\$	1.00						
13%	43%	80%	100%	100%	100%	100%	100%	100%	100%	0.00%	2	\$	1.00						
FTTP Deployment Completion Fees										Year Completed									
1	2	3	4	5						0.00%	1	\$	1.00						
Upfront Payment										0.00%	2	\$	1.00						
Backbone Completion Payment										0.00%	3	\$	1.00						
Hub Completion Payment										0.00%									
Net Revenue										Sensitivity									
Miles	-	-	-	-	-	-	-	-	-										
Strands	-	-	-	-	-	-	-	-	-										
MRC per strand	\$	-	\$	-	base case														
#DIV/0!	per strand mile			strands						403	miles								
Fiber leases (net)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 plus													
Avoided Costs (net)	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	
Unrestricted Cash Balance (yr. 1 to yr. 10)	1	3	5	7	9	10													
Unrestricted Cash Balance (yr. 11 to yr. 20)	\$	38,250	\$	34,320	\$	42,450	\$	35,880	\$	18,600	\$	8,220	\$	4,550	\$	6,930	\$	15,650	\$
	\$	51,290	\$	77,770	\$	109,720	\$	146,920	\$	188,460	\$	234,570	\$	284,990	\$	339,440	\$	397,620	\$
30,510																		458,170	
Other Revenues/Services										Annual Retail Price									
Digital Equipment Rental	\$	-	per month per digital customer																
Advertising	Year 1	Year 2	Year 3	Year 4	Year 5+	Year 6													
Utility Allocation	\$	-	\$	-	\$	-	\$	-	\$	(Revenue per year)									
CAF2 Funds	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$
CAF2 Fund Potential	\$	-	Include?	no															
CAF2 Funding Percentage	0%	0%	0%	50%	100%					100%	100%								
Sales (residential KwHr)	132,109,908	2018 projection (kWhr)		0.54%															
Price	\$	0.032	per kWhr (net)	\$	0.109	per kWhr (retail)	\$	0.077	per kWhr (wholesale)										
Realization (increased consumption by year)	10.00% increase due to longer stays	\$	418,700	Include? no															
Provider Fee (open access)	\$	-	\$	-	\$	-	\$	-	\$										
Connection Fee (new Internet customer)	\$	75																	

## Project Assumptions

### Operation and Maintenance Expenses

Annual Fixed Operating Expense										
	Year 1	Year 2	Year 3	Year 4	Year 5 plus					
Insurance	\$ 15,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000					
Utilities	\$ -	\$ -	\$ -	\$ -	\$ -					
Office Expenses	\$ -	\$ -	\$ -	\$ -	\$ -					
Facility Lease	\$ -	\$ -	\$ -	\$ -	\$ -					
Locates & Ticket Processing	\$ 12,600	\$ 62,900	\$ 125,800	\$ 125,800	\$ 125,800	\$ 4,000	per month per 100 miles	Year 1	10.00%	Year 2
Peering (Port Charges)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 0	Mbps per customer 50 miles standard in Metro area		50.00%	100.00%
Contingency	\$ 10,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000					
Billing Maintenance Contract	\$ -	\$ -	\$ -	\$ -	\$ -					
Fiber & Network Maintenance	\$ -	Annual + 0.100% Fiber Implementation Cost	\$ -	\$ -	\$ -					
Vendor Maintenance Contracts	\$ -	\$ -	\$ -	\$ -	\$ -		5.00% Annual Contract Amount From Electronics summary			
Annual Variable Operating Expense (not including DIA)										
Education and Training	2.00% percent of direct payroll									
Customer Handholding	\$ -	per subscriber per month								
Customer Billing (Unit)	\$ -	per bill								
Allowance for Bad Debts	0.00% percentage of revenues									
Customer Churn (annual)	0.00% Customer Promotions/Acquisition									
tbd	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 150				
Internet Connection Fee										
PSTN Connection Fee	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	per Mbps per month			
Minimum Bandwidth	\$ 2,000	Mbps	\$ -	per month	\$ -		In partner fees? yes		\$ 4,000	per year
Pole Attachment Expense										
Attachment Fees	1,156 poles at \$ 15.00 per year									
		]								
Taxes										
Patronage Capital Reserve										
	0% of positive net income (prior year)									
By year	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Cumulative	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Draws	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Net Draws	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Net Cumulative	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	1	2	3	4	5	6	7	8	9	10
										11
										12
										13
Operating Reserve	0% of annual expenses (based on year 6 operation costs) \$									
Fund in year	\$ 2	(enter 0 to 5)								
Contribution	\$ -	\$ -	\$ -	\$ -	\$ -					
Balance	\$ -	\$ -	\$ -	\$ -	\$ -					
Franchise Fees	0% percent of access fee revenue 0% percent of CATV revenue									
City and State Tax (Utility Fee)	0.0000% percent of revenue									
Property Tax	0.00% of outside plant									
Utility Fees - Pass Through to Customer	Starts in year State 0.0000% Paid by contractor City 0.0000%									
Low Income Assistance										
Assistance Rate	\$ -	0% for	0% of households	Passing fee						
			0% of households	Target monthly passing fee for eligible households	Net HH Discount (annual)	1	2	3	4	5
			- Households with discount		Discount \$	-	- Start in year	-	-	-
					Weighting	13%	43%	80%	100%	100%

## Project Assumptions

## ***Labor Expense***

### **Labor (Direct)**

## Project Assumptions

### Market Size

Residential	3,299	0 Applies to All Services	0.00%	Years 2 to 5 for growth rate	0	0.00%	0	3,299	3,299	3,299	3,299
Number of Potential Subscribers	3,299										
Potential Multi-Housing (not used)	0	Applies to All Services									

### Subscriber Growth Rate

Years 2 to 5 for growth rate 0 0.00% 0

3,299 3,299 3,299 3,299 3,299

### Televisions per Household

2 Customer pays for 0 installs

### Market Size

Year 1	Year 2	Year 3	Year 4	Year 5
55%	45%	40%	35%	30%

Year 6	Year 7	Year 8	Year 9	Year 10+
30%	30%	30%	30%	30%

### Market Share Percentage of Market

Year 1	Year 2	Year 3	Year 4	Year 5
1%	11%	23%	45%	45%

Year 6	Year 7	Year 8	Year 9	Year 10+
0.75%	5.09%	9.05%	15.84%	13.58%

### Market Share Percentage of Market

Year 6	Year 7	Year 8	Year 9	Year 10+
45%	45%	45%	45%	45%

13.58%	13.58%	13.58%	13.58%	13.58%
--------	--------	--------	--------	--------

### Package Take Rate

#### Digital

Year 1	Year 2	Year 3	Year 4	Year 5+
100%	100%	100%	100%	100%

### Commercial

#### Number of Potential Subscribers

174 Applies to All Services
-----------------------------

#### Subscriber Growth Rate

0.00%
-------

Years 2 to 5 for growth rate
------------------------------

0
---

0.00%
-------

174	174	174	174	174
-----	-----	-----	-----	-----

### Televisions per Business

2
---

### Market Size

Year 1	Year 2	Year 3	Year 4	Year 5
--------	--------	--------	--------	--------

10%	10%	10%	10%	8%
-----	-----	-----	-----	----

Year 6	Year 7	Year 8	Year 9	Year 10+
--------	--------	--------	--------	----------

8%	8%	8%	8%	8%
----	----	----	----	----

### Market Share Take Rate

#### Take Rate

Year 1	Year 2	Year 3	Year 4	Year 5
--------	--------	--------	--------	--------

1%	11%	23%	45%	45%
----	-----	-----	-----	-----

0.14%	1.13%	2.26%	4.53%	3.62%
-------	-------	-------	-------	-------

Year 6	Year 7	Year 8	Year 9	Year 10+
--------	--------	--------	--------	----------

45%	45%	45%	45%	45%
-----	-----	-----	-----	-----

3.62%	3.62%	3.62%	3.62%	3.62%
-------	-------	-------	-------	-------

Package Take Rate same as Residential

Wildwood MO	3,299	45.25% MS Ceiling	3,299	3,299	3,299	3,299	3,299	3,299	3,299	3,299	3,299
tbd	-	40.00% MS Ceiling	tbd	tbd	-	40.00% MS Ceiling	tbd	tbd	-	40.00% MS Ceiling	tbd
3,473			3,473	3,473		3,473	3,473	3,473		3,473	3,473

MS reference only

3,299

-

174

-

3,473

1.00	yr. 1	1%	yr. 2	11%	yr. 3	23%	yr. 4	45%
------	-------	----	-------	-----	-------	-----	-------	-----

Wildwood MO	174	45.25% MS Ceiling	0	0	0	0	0	0	CPE Funding
tbd	-	0.00% MS Ceiling	tbd	tbd	-	0.00% MS Ceiling	tbd	tbd	0.00%
174		45.25% MS Weighted	174	174		45.25% MS Weighted	174	174	0.00%

MS reference only

1.00	yr. 1	1.36%	yr. 2	11.31%	yr. 3	22.63%	yr. 4	45.25%
------	-------	-------	-------	--------	-------	--------	-------	--------

## Project Assumptions

### Penetration Rates - Data

Residential Internet Services										Commercial Internet Services									
Number of Potential New Subscribers										Number of Potential Subscribers									
Initial Data Users	100%	Considered in the Take Rate								Residential Business	45.3%	3,299	1,493	Output to "Electronics Totals"					
Occupancy Rate	100%	Considered in the Take Rate									45.3%	174	79	Output to "Electronics Totals"					
Projected Market Size	Year 1	100%	Year 2	100%	Year 3	100%	Year 4	100%	Year 5				3,473	1,572					
	Year 6	100%	Year 7	100%	Year 8	100%	Year 9	100%	Year 10+	100%				1,572	1,572	- Check Sum			
Market Share Take Rate	Year 1	1%	Year 2	11%	Year 3	23%	Year 4	45%	Year 5	45%	yr. 1	1.36%	0.567						
	Year 6	1.4%	Year 7	11.3%	Year 8	22.6%	Year 9	45.3%	Year 10+	45.3%	Market share multiplier for sensitivity analysis	1.00	11.31%	22.63%	yr. 2	yr. 3	yr. 4	-11.5%	
Market Share Take Rate	Year 1	45%	Year 2	45%	Year 3	45%	Year 4	45%	Year 5	45%	45.3%	45.250%	20						
	Year 6	45.25%	Year 7	45.25%	Year 8	45.25%	Year 9	45.25%	Year 10+	45.25%			-0.005725	5					
Package Take Rate	Year 1	0%	Year 2	0%	Year 3	0%	Year 4	0%	Year 5	0%									
R 50																			
R 100																			
R Gbps																			
tbd																			
tbd																			
Commercial Internet Services										Residential Business									
Number of Potential Subscribers											45.3%	3,299	1,493	Output to "Electronics Totals"					
Initial Data Users	100%	Considered in the Take Rate																	
Occupancy Rate	100%	Considered in the Take Rate																	
Projected Market Size	Year 1	100%	Year 2	100%	Year 3	100%	Year 4	100%	Year 5	100%									
	Year 6	100%	Year 7	100%	Year 8	100%	Year 9	100%	Year 10+	100%									
Market Share Take Rate	Year 1	1%	Year 2	11%	Year 3	23%	Year 4	45%	Year 5	45%	yr. 1	1.36%	0.567						
	Year 6	1.4%	Year 7	11.3%	Year 8	22.6%	Year 9	45.3%	Year 10+	45.3%	Market share multiplier for sensitivity analysis	1.00	11.31%	22.63%	yr. 2	yr. 3	yr. 4	-11.5%	
Market Share Take Rate	Year 1	45%	Year 2	45%	Year 3	45%	Year 4	45%	Year 5	45%	45.3%	45.250%	20						
	Year 6	45.25%	Year 7	45.25%	Year 8	45.25%	Year 9	45.25%	Year 10+	45.25%			-0.005725	5					
Package Take Rate	Year 1	0.00%	Year 2	0%	Year 3	0%	Year 4	0%	Year 5	0%									
B 50																			
B 100																			
B 1 Gbps (small commercial)																			
B 1 Gbps (medium commercial)																			
1 Gbps (with SLA)																			

## Project Assumptions

### Penetration Rates - Voice

#### Residential Phone Services

	Year 1	Year 2	Year 3	Year 4	Year 5					
Projected Market Size		35%	40%	35%	30%	25%				
Market Share Take Rate	Year 6	Year 7	Year 8	Year 9	Year 10+					
Market Share Take Rate	Year 6	Year 7	Year 8	Year 9	Year 10+					
Package Take Rate	Year 1	Year 2	Year 3	Year 4	Year 5					

	Year 1	Year 2	Year 3	Year 4	Year 5					
Unlimited Local Calling		0%	0%	0%	0%	0%				
Unlimited Local and Long Distance Business Package (Average)	100%	100%	100%	100%	100%					

#### Commercial Phone Services

	Year 1	Year 2	Year 3	Year 4	Year 5					
Projected Market Size		50%	45%	40%	40%	40%				
Market Share Take Rate	Year 6	Year 7	Year 8	Year 9	Year 10+					
Market Share Take Rate	Year 6	Year 7	Year 8	Year 9	Year 10+					
Package Take Rate	Year 1	Year 2	Year 3	Year 4	Year 5					

	Year 1	Year 2	Year 3	Year 4	Year 5					
Unlimited Local Calling		0%	0%	0%	0%	0%				
Unlimited Local and Long Distance Business Package (Average)	0%	0%	0%	0%	0%					

**Bundling**  
Bundling Factor<sup>1</sup> 0.00 SET TO ZERO IF ASSUMING HH&B GET INTERNET AS BASE, OTHER SERVICES ARE ADD ONS (SET TO ZERO FOR COMMUNITY ACCESS)

## Project Assumptions

'Bundling Factor accounts for the percentage of customers who subscribe to two or more services. Total number of customers are calculated as (Max Customers - Min Customers)\*Bundling Factor + Min Customers (see Sheets "Projected Total Residential Customers" and "Projected Total Commercial Customers").

<sup>2</sup>Approximate required additional annual capital to account for damages and early replacements.

	1	5	10	
P&I	\$ 384,000	\$ 2,385,430	\$ 2,385,430	Example if CPI is
Operating Exp	<u>336,390</u>	<u>478,380</u>	<u>540,820</u>	Passing Fee should increase by at least
Total	\$ 720,390	\$ 2,863,810	\$ 2,926,250	
Operating Percentage	46.70%	16.70%	18.48%	

Example if CPI is  
Passing Fee should increase by at least

5.00%  
0.92%

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

#### Scenarios

##### Scenario 1 - Per Passing Fee of \$69 Per Month (Huntsville Model).

Income Statement	1	5
Total Revenues	\$ 89,940	\$ 2,875,640
Total Cash Expenses	(336,390)	(478,380)
Depreciation	(459,320)	(1,468,050)
Interest Expense	(384,000)	(1,154,880)
City Fees	-	-
Net Income	\$ (1,089,770)	\$ (225,670)

Cash Flow Statement	1	5
Unrestricted Cash Balance	\$ 38,250	\$ 18,600
Depreciation Reserve	-	88,080
Debt Service Reserve	-	-
Total Cash Balance	\$ 38,250	\$ 106,680
Total Cash Balance (after investment payments)	\$ 38,250	\$ 106,680

#### Investment Metrics

Internal Rate of Return (IRR)

Net Present Value (NPV) at a 4 percent discount rate

Internal Rate of Return (IRR)

Net Present Value (NPV) at a 4 percent discount rate

Net Cash Flow (Year 5) \$ (17,280)

Investments (Year 1 to Year 5)	\$ -
Bonds/Loans (Year 1 to Year 5)	\$ 31,330,000
Loans (Year 1 to Year 5)	\$ -
DSCR (Year 6)	1.00

#### Revenue Assumptions - Lessor Passing Fees

Lessor Payment - per passing per month	\$ 69.00
Multiplier	9.20
Drops to in year 3.	\$ 69.00
Drops to in year 5.	\$ 69.00

Lessor Payment - per subscriber per month	\$ -
Multiplier	9.20
Drops to in year 3.	\$ -
Drops to in year 5.	\$ -

#### One-Time Payments

Upfront Payment	\$ -
Backbone Completion Payment	\$ -
Hub Completion Payment	\$ -
Total	\$ -

#### Revenue Assumptions - Per Premises Passing Fee

Passing Fee Residential (month)	\$ -
Passing Fee Business (month)	\$ -
Open Access (RSP) Fee Residential (month)	\$ -
Open Access (RSP) Fee Business (month)	\$ -

#### Market Assumptions

Take Rate 45.25%

#### Scenario 1 - tbd.

Income Statement	1	5
Total Revenues	\$ 400,160	\$ 10,861,780
Total Cash Expenses	(1,873,390)	(7,357,320)
Depreciation	(878,340)	(3,119,110)
Interest Expense	(588,000)	(1,735,250)
City Fees	37,900	1,086,180
Net Income	\$ (2,901,670)	\$ (263,720)

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

#### Scenarios

Cash Flow Statement	1	5
Unrestricted Cash Balance	\$ (41,330)	\$ (6,666,410)
Depreciation Reserve	-	3,192,770
Debt Service Reserve	<u>735,000</u>	<u>2,347,500</u>
Total Cash Balance	\$ 693,670	\$ (1,126,140)
Total Cash Balance (after investment payments)	\$ 693,670	\$ (1,126,140)

#### Investment Metrics

Internal Rate of Return (IRR)  
 Net Present Value (NPV) at a 4 percent discount rate

Internal Rate of Return (IRR)  
 Net Present Value (NPV) at a 4 percent discount rate

Net Cash Flow (Year 5)	\$ (2,337,880)
Investments (Year 1 to Year 5)	\$ -
Bonds/Loans (Year 1 to Year 5)	\$ 46,950,000
Loans (Year 1 to Year 5)	\$ -
DSCR (Year 6)	0.34

#### Revenue Assumptions - Lessor Passing Fees

Lessor Payment - per passing per month	\$ -
Multiplier	-
Drops to in year 3.	\$ -
Drops to in year 5.	\$ -
 Lessor Payment - per subscriber per month	\$ -
Multiplier	-
Drops to in year 3.	\$ -
Drops to in year 5.	\$ -
 One-Time Payments	
Upfront Payment	\$ -
Backbone Completion Payment	\$ -
Hub Completion Payment	\$ -
Total	\$ -

#### Revenue Assumptions - Per Premises Passing Fee

Passing Fee Residential (month)	\$ -
Passing Fee Business (month)	\$ -
Open Access (RSP) Fee Residential (month)	\$ -
Open Access (RSP) Fee Business (month)	\$ -

#### Market Assumptions

Take Rate	45.25%
-----------	--------

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

#### Scenarios

**Scenario 2 - tbd.**

Income Statement	1	5
Total Revenues	\$ 804,420	\$ 21,951,950
Total Cash Expenses	(2,037,890)	(12,769,390)
Depreciation	(1,093,000)	(4,855,210)
Interest Expense	(676,000)	(2,329,290)
City Fees	<u>76,180</u>	<u>2,195,200</u>
Net Income	\$ (2,926,290)	\$ 4,193,260

Cash Flow Statement	1	5
Unrestricted Cash Balance	\$ 70,450	\$ 1,843,850
Depreciation Reserve	-	4,837,810
Debt Service Reserve	<u>845,000</u>	<u>3,127,500</u>
Total Cash Balance	\$ 915,450	\$ 9,809,160

Total Cash Balance (after investment payments)	\$ 915,450	\$ 9,809,160
--	------------	--------------

#### Investment Metrics

Internal Rate of Return (IRR)

Net Present Value (NPV) at a 4 percent discount rate

Internal Rate of Return (IRR)

Net Present Value (NPV) at a 4 percent discount rate

Net Cash Flow (Year 5)	\$ 403,630
Investments (Year 1 to Year 5)	\$ -
Bonds/Loans (Year 1 to Year 5)	\$ 62,550,000
Loans (Year 1 to Year 5)	\$ -
DSCR (Year 6)	1.08

#### Revenue Assumptions - Lessor Passing Fees

Lessor Payment - per passing per month	\$ -
Multiplier	-
Drops to in year 3.	\$ -
Drops to in year 5.	\$ -

Lessor Payment - per subscriber per month	\$ -
Multiplier	-
Drops to in year 3.	\$ -
Drops to in year 5.	\$ -

#### One-Time Payments

Upfront Payment	\$ -
Backbone Completion Payment	-
Hub Completion Payment	<u>-</u>
Total	\$ -

#### Revenue Assumptions - Per Premises Passing Fee

Passing Fee Residential (month)	\$ -
Passing Fee Business (month)	\$ -
Open Access (RSP) Fee Residential (month)	\$ -
Open Access (RSP) Fee Business (month)	\$ -

#### Market Assumptions

Take Rate	91.50%
-----------	--------

**Scenario 3 - tbd.**

Income Statement	1	5
Total Revenues	\$ 310,820	\$ 10,013,640
Total Cash Expenses	(1,716,460)	(3,982,430)
Depreciation	(878,340)	(3,119,110)
Interest Expense	(588,000)	(1,735,250)
City Fees	<u>28,960</u>	<u>1,001,360</u>
Net Income	\$ (2,843,020)	\$ 2,178,210

Cash Flow Statement	1	5
Unrestricted Cash Balance	\$ 35,200	\$ 514,720

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Scenarios**

Depreciation Reserve	-	3,192,770
Debt Service Reserve	735,000	2,347,500
Total Cash Balance	\$ 770,200	\$ 6,054,990
Total Cash Balance (after investment payments)	\$ 770,200	\$ 6,054,990

**Investment Metrics**

Internal Rate of Return (IRR)  
 Net Present Value (NPV) at a 4 percent discount rate

Internal Rate of Return (IRR)  
 Net Present Value (NPV) at a 4 percent discount rate

Net Cash Flow (Year 5)	\$ 273,690
Investments (Year 1 to Year 5)	\$ -
Bonds/Loans (Year 1 to Year 5)	\$ 46,950,000
Loans (Year 1 to Year 5)	\$ -
DSCR (Year 6)	1.09

**Revenue Assumptions - Lessor Passing Fees**

Lessor Payment - per passing per month	\$ -
Multiplier	-
Drops to in year 3.	\$ -
Drops to in year 5.	\$ -

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Financial Summary Tables**

	<b>Year 1</b>	<b>Year 5</b>	<b>Year 10</b>	<b>Year 15</b>	<b>Year 20</b>
<b>Operating Expenses</b>					
Support Services	\$ -	\$ -	\$ -	\$ -	\$ -
Insurance	15,000	27,000	29,800	32,910	36,330
Utilities	-	-	-	-	-
Office Expenses	-	-	-	-	-
Facility Lease	-	-	-	-	-
Locates & Ticket Processing	12,600	135,860	150,000	165,610	182,860
Peering (Port Charges)	-	-	-	-	-
Contingency	10,000	21,600	23,850	26,350	29,100
Billing Maintenance Contract	-	-	-	-	-
Fiber & Network Maintenance	8,650	31,130	34,370	37,950	41,900
Vendor Maintenance Contracts	-	-	-	-	-
Legal & Consulting	50,000	10,800	11,920	13,160	14,520
Planning	-	-	-	-	-
Consulting	-	-	-	-	-
Marketing	-	-	-	-	-
Education and Training	4,660	4,570	5,300	6,150	7,130
Customer Handholding	-	-	-	-	-
Customer Billing (Unit)	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-
Churn (acquisition costs)	-	-	-	-	-
tbd	-	-	-	-	-
CLEC Cerification	-	-	-	-	-
PSTN Connection Fee	-	-	-	-	-
Low Income Assistance	-	-	-	-	-
Pole Attachment Expense	2,600	18,730	20,460	22,370	24,970
Video	-	-	-	-	-
Internet	-	-	-	-	-
Voice	-	-	-	-	-
	<b>Sub-Total</b>	<b>\$ 103,510</b>	<b>\$ 249,690</b>	<b>\$ 275,700</b>	<b>\$ 304,500</b>
Labor Expenses		<b>\$ 232,880</b>	<b>\$ 228,690</b>	<b>\$ 265,120</b>	<b>\$ 356,300</b>
	<b>Sub-Total</b>	<b>\$ 232,880</b>	<b>\$ 228,690</b>	<b>\$ 265,120</b>	<b>\$ 356,300</b>
	<b>Total Expenses</b>	<b>\$ 336,390</b>	<b>\$ 478,380</b>	<b>\$ 540,820</b>	<b>\$ 693,110</b>
Principal and Interest		<b>\$ 384,000</b>	<b>\$ 2,385,180</b>	<b>\$ 2,385,290</b>	<b>\$ 2,385,390</b>
City Fee		<b>\$ 384,000</b>	<b>\$ 2,385,180</b>	<b>\$ 2,385,290</b>	<b>\$ 2,386,120</b>
	<b>Sub-Total</b>	<b>\$ 384,000</b>	<b>\$ 2,385,180</b>	<b>\$ 2,385,290</b>	<b>\$ 2,385,390</b>
<b>Total Expenses, P&amp;I, and Taxes</b>	<b>\$ 720,390</b>	<b>\$ 2,863,560</b>	<b>\$ 2,926,110</b>	<b>\$ 2,997,230</b>	<b>\$ 3,079,230</b>

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Financial Summary Tables**

	<b>Year 1</b>	<b>Year 5</b>	<b>Year 10</b>	<b>Year 15</b>	<b>Year 20</b>
<b>Income Statement</b>					
<b>a. Revenues</b>					
Video	\$ -	\$ -	\$ -	\$ -	\$ -
Internet - Residential	-	-	-	-	-
Internet - Business	-	-	-	-	-
Voice	-	-	-	-	-
Connection Fee (net)	-	-	-	-	-
Per Passing	89,940	2,875,640	2,970,330	3,068,130	3,169,140
Per Customer	-	-	-	-	-
Special Assessment	-	-	-	-	-
Special Assessment Payment	-	-	-	-	-
Property Tax	-	-	-	-	-
Upfront Payment	-	-	-	-	-
Backbone Completion Payment	-	-	-	-	-
Hub Completion Payment	-	-	-	-	-
Fiber leases (net)	-	-	-	-	-
Avoided Costs (net)	-	-	-	-	-
Provider Fees	-	-	-	-	-
Passing Fees	-	-	-	-	-
CAF2 Funds	-	-	-	-	-
Increased Residential kWh sales	-	-	-	-	-
Ancillary Revenues	-	-	-	-	-
<b>Total</b>	<b>\$ 89,940</b>	<b>\$ 2,875,640</b>	<b>\$ 2,970,330</b>	<b>\$ 3,068,130</b>	<b>\$ 3,169,140</b>
<b>b. Content Fees</b>					
Video	\$ -	\$ -	\$ -	\$ -	\$ -
Internet	-	-	-	-	-
Voice	-	-	-	-	-
<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>c. Operating Costs</b>					
Operation Costs	\$ 103,510	\$ 249,690	\$ 275,700	\$ 304,500	\$ 336,810
Labor Costs	\$ 232,880	\$ 228,690	\$ 265,120	\$ 307,340	\$ 356,300
<b>Total</b>	<b>\$ 336,390</b>	<b>\$ 478,380</b>	<b>\$ 540,820</b>	<b>\$ 611,840</b>	<b>\$ 693,110</b>
<b>d. EBITDA</b>					
	\$ (246,450)	\$ 2,397,260	\$ 2,429,510	\$ 2,456,290	\$ 2,476,030
<b>e. Depreciation</b>					
	459,320	1,468,050	1,468,050	1,468,050	1,468,050
<b>f. Operating Income (EBITDA less Depreciation)</b>					
	\$ (705,770)	\$ 929,210	\$ 961,460	\$ 988,240	\$ 1,007,980
<b>g. Non-Operating Income</b>					
Interest Income	\$ -	\$ 220	\$ 110	\$ 10	\$ 380
Interest Expense (Bond A)	-	-	-	-	-
Interest Expense (Bond B)	(384,000)	(1,155,100)	(888,500)	(564,200)	(169,800)
Interest Expense (Loan)	-	-	-	-	-
CTC Technology & Energy	-	-	-	-	-

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Financial Summary Tables**

	Total	\$ (384,000)	\$ (1,154,880)	\$ (888,390)	\$ (564,190)	\$ (169,420)
<b>h. Net Income (before taxes)</b>		\$ (1,089,770)	\$ (225,670)	\$ 73,070	\$ 424,050	\$ 838,560
<b>i. City Fee</b>		\$ -	\$ -	\$ -	\$ -	\$ -
<b>j. Net Income</b>		\$ (1,089,770)	\$ (225,670)	\$ 73,070	\$ 424,050	\$ 838,560

**Wildwood MO**  
**Dark FTTP**  
**Low Density Build**  
**Westminster Model - Rev 3**  
**May 19, 2019**

**Financial Summary Tables**

	<b>Year 1</b>	<b>Year 5</b>	<b>Year 10</b>	<b>Year 15</b>	<b>Year 20</b>
<b>Cash Flow Statement</b>					
<b>a. Net Income</b>	\$ (1,089,770)	\$ (225,670)	\$ 73,070	\$ 424,050	\$ 838,560
<b>b. Cash Outflows</b>					
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -
Depreciation Reserve	\$ -	\$ (29,360)	\$ (29,360)	\$ (29,360)	\$ (29,360)
Financing	\$ (96,000)	\$ -	\$ -	\$ -	\$ -
Capital Expenditures	\$ (8,835,300)	\$ -	\$ -	\$ (189,000)	\$ -
<b>Total</b>	<b>\$ (8,931,300)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (218,360)</b>	<b>\$ (29,360)</b>
<b>c. Cash Inflows</b>					
Interest Reserve	\$ -	\$ -	\$ -	\$ -	\$ -
Depreciation Reserve	\$ -	\$ -	\$ -	\$ 189,000	\$ -
20-Year Bond/Loan Proceeds	\$ 9,600,000	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	<b>\$ 9,600,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 189,000</b>	<b>\$ -</b>
<b>d. Total Cash Outflows and Inflows</b>	<b>\$ 668,700</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>	<b>\$ (29,360)</b>
<b>e. Non-Cash Expenses - Depreciation</b>	<b>\$ 459,320</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>	<b>\$ 1,468,050</b>
<b>f. Adjustments</b>					
Proceeds from Additional Cash Flows (10 Year Bond)	\$ -	\$ -	\$ -	\$ -	\$ -
Proceeds from Additional Cash Flows (20 Year Bond)	\$ (9,600,000)	\$ -	\$ -	\$ -	\$ -
Proceeds from Additional Cash Flows (Loan)	\$ -	\$ -	\$ -	\$ -	\$ -
<b>g. Adjusted Available Net Revenue</b>	<b>\$ (9,561,750)</b>	<b>\$ 1,213,020</b>	<b>\$ 1,511,760</b>	<b>\$ 1,862,740</b>	<b>\$ 2,277,250</b>
<b>h. Principal Payments on Debt</b>					
10 Year Bond/Loan Principal	\$ -	\$ -	\$ -	\$ -	\$ -
20 Year Bond/Loan Principal	\$ -	\$ 1,230,300	\$ 1,496,900	\$ 1,821,200	\$ 2,216,700
<b>Total</b>	<b>\$ -</b>	<b>\$ 1,230,300</b>	<b>\$ 1,496,900</b>	<b>\$ 1,821,200</b>	<b>\$ 2,216,700</b>
<b>i. Net Cash</b>	<b>\$ 38,250</b>	<b>\$ (17,280)</b>	<b>\$ 14,860</b>	<b>\$ 41,540</b>	<b>\$ 60,550</b>
<b>j. Cash Balance</b>					
Unrestricted Cash Balance	\$ 38,250	\$ 18,600	\$ 30,510	\$ 188,460	\$ 458,170
Depreciation Reserve	\$ -	\$ 88,080	\$ 45,880	\$ 3,680	\$ 150,480
Debt Service Reserve	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total Cash Balance</b>	<b>\$ 38,250</b>	<b>\$ 106,680</b>	<b>\$ 76,390</b>	<b>\$ 192,140</b>	<b>\$ 608,650</b>

Notes

Year 21 plus expenses needs escalations applied

Rows 26-26 and 120-121 on IS (passing fees) need escualation applied and formula verified

## **Appendix E: Fiber Cost Estimate**

The full working model is supplied as a separate document.

## FTTP Network Cost Component Breakdown

Cost Component	High Density	Medium Density	Low Density	Backbone		Total Estimated Cost	Total Estimated Cost With Contingency
<b>Backbone OSP Construction Costs</b>							
OSP Engineering	\$ 666,000	\$ 894,000	\$ 2,725,000	\$ 1,233,000	\$ -	\$ 5,518,000	\$ 5,518,000
Quality Control/Quality Assurance	\$ 353,000	\$ 474,000	\$ 1,446,000	\$ 654,000	\$ -	\$ 2,927,000	\$ 2,927,000
<b>General OSP Construction Cost</b>	<b>\$ 5,880,000</b>	<b>\$ 7,248,000</b>	<b>\$ 20,986,000</b>	<b>\$ 2,202,000</b>	<b>\$ -</b>	<b>\$ 36,316,000</b>	<b>\$ 36,316,000</b>
Special Crossings	\$ 56,000	\$ 242,000	\$ 608,000	\$ -	\$ -	\$ 906,000	\$ 906,000
Backbone and Distribution Plant Splicing	\$ 272,000	\$ 233,000	\$ 511,000	\$ 45,000	\$ -	\$ 1,061,000	\$ 1,061,000
Backbone Hub, Termination, and Testing	\$ 963,000	\$ 987,000	\$ 182,000	\$ 181,000	\$ -	\$ 2,313,000	\$ 2,313,000
<i><b>Subtotal:</b></i>						<b>\$ 49,041,000</b>	<b>\$ 49,041,000</b>
<b>Backbone Network Electronics Costs</b>							
Core Network Equipment	\$ 590,000	\$ 354,000	\$ 354,000	\$ -	\$ -	\$ 1,298,000	\$ 1,298,000
Distribution and Access Equipment (GPON OLT)	\$ 459,000	\$ 255,000	\$ 255,000	\$ -	\$ -	\$ 969,000	\$ 969,000
<i><b>Subtotal:</b></i>						<b>\$ 2,267,000</b>	<b>\$ 2,267,000</b>
<b>Subscriber Activation Costs</b>							
FTTP Service Drop and Lateral Installations	\$ 2,704,000	\$ 2,505,000	\$ 4,812,000	\$ -	\$ -	\$ 10,021,000	\$ 10,021,000
Customer Premises Equipment and Installation	\$ 1,309,000	\$ 786,000	\$ 770,000	\$ -	\$ -	\$ 2,865,000	\$ 2,865,000
<i><b>Subtotal:</b></i>						<b>\$ 12,886,000</b>	<b>\$ 12,886,000</b>
<b>Total Estimated Cost:</b>	<b>\$ 13,252,000</b>	<b>\$ 13,978,000</b>	<b>\$ 32,649,000</b>	<b>\$ 4,315,000</b>	<b>\$ -</b>	<b>\$ 64,194,000</b>	<b>\$ 64,194,000</b>
<b>Service Areas Included:</b>							
<b>Total Estimated Passings:</b>	<b>5,904</b>	<b>3,544</b>	<b>3,473</b>	<b>-</b>	<b>-</b>	<b>12,921</b>	
	<b>9,628,000</b>	<b>11,516,000</b>	<b>27,896,000</b>				

3,795 Average per passing cost

## 175.45 Passing Cost

214.27 Average OLT cost see step function below

2,192.67 Average drop cost      \$ 105,000 with 0% take rate

## 633.52 Average CPE and installation (w/o OLT)

\$ 1,438,333

9.2

OSP w/o BB	\$ 8,190,000	\$ 10,078,000	\$ 26,458,000	<b>Contingency:</b>		
OSP cost per passing (w/o BB)	\$ 1,387	\$ 2,844	\$ 7,618	<b>Total Cost:</b>		\$ 64,194

Average Drop Cost	\$ 1,309	\$ 2,020	\$ 3,959	
Annual Fiber Maintenance:			\$ 591,000	1%
Annual Equipment Maintenance:			\$ 275,000	

Take rate: 25% \$ 36,964,000

Take-rate:	35%	\$ 36,964,000
Total Plant Mileage:	403.1	

Total Plant Mileage:	403.1	\$ 49,041.000
Aerial Plant Mileage:	141.1	

**Underground Plant Mileage:** 262.0

Total Passings: 12,921 Note: Based on design encompassing total developed and undeveloped parcels passed.

% Residential Passings:	95%
-------------------------	-----

% Commercial Passings: 5%

Total Residential Passings: 12,275

Total Commercial Passings: 646  
Percentage Attended: 35%

Percentage Aerial:	35%
Percentage Underground:	65%

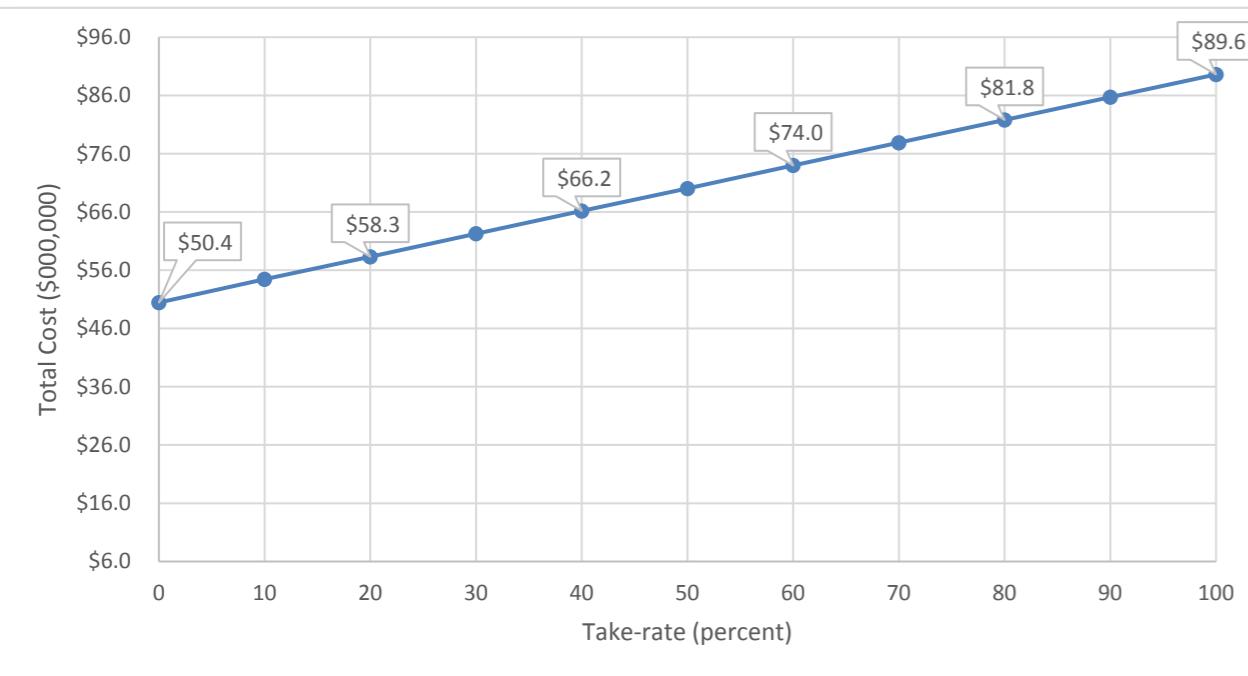
**1** Note: Based on design encompassing total developed and undeveloped parcels passed

Electronics discount:	40%
Electronics service discount:	10%

Maintenance Fees 0% Applied to OLT in above table  
 Maintenance Fees 15% Applied to total in "FTTP Distribution Electronics"

#### Notes and Assumptions:

- Service Drop and Lateral Installation costs assume that a lateral cable is terminated at a single common demarcation point internal to all businesses and large MDU structures, but does not include service drops or wiring to each customer unit.
- Take rate applies to business and residential buildings with 19 or fewer units.
- Assumes FDC service areas of approximately 288 passings.
- Design model encompasses system capacity to support all developed and undeveloped parcels passed.
- Assumes each FDC is comprised of an equipment cabinet to support active equipment, equipped with active heat exchanger and backup power.
- Assumes home run fiber strand architecture from FDC to tap for every passing (no passive splitters downstream of the FDC).
- Assumes the use of Corning Optisheath-style tap housings with manufacturer-assembled stub cables.



Take-Rate (%)	Total Cost (\$M)		
0 \$	50.4 \$	50,444,000 \$	64,194,000
10 \$	54.5 \$	54,457,000 \$	64,194,000
20 \$	58.3 \$	58,308,000 \$	64,194,000
30 \$	62.3 \$	62,266,000 \$	64,194,000
40 \$	66.2 \$	66,174,000 \$	64,194,000
50 \$	70.0 \$	70,026,000 \$	64,194,000
60 \$	74.0 \$	73,984,000 \$	64,194,000
70 \$	77.9 \$	77,892,000 \$	64,194,000
80 \$	81.8 \$	81,797,000 \$	64,194,000
90 \$	85.7 \$	85,701,000 \$	64,194,000
100 \$	89.6 \$	89,604,000 \$	64,194,000

TR

35.0%

Distribution and Access Equipment (GPON OLT) Does not include core

Take-Rate (%)	Total Cost (\$M)		Total Cost		
	20%	40%	60%	80%	100%
20%	\$ 0.56	\$ 1.12	\$ 1.63	\$ 2.14	\$ 2.65
40%	\$ 1.12	\$ 2.24	\$ 3.26	\$ 4.28	\$ 5.30
60%	\$ 1.63	\$ 3.26	\$ 4.89	\$ 6.52	\$ 8.15
80%	\$ 2.14	\$ 4.28	\$ 6.42	\$ 8.56	\$ 10.70
100%	\$ 2.65	\$ 5.30	\$ 8.15	\$ 11.28	\$ 14.00

## Summary of FTTP OSP Cost Estimates by Phase

Phase	Distribution Plant Mileage	Total Cost (with drops)	Total Cost (without drops)	Passings
Total:	<b>403.1</b>	\$ <b>59,060,000</b>	\$ <b>49,040,000</b>	<b>12,921</b>
Phase 1	62.7	\$ 10,894,065	\$ 8,189,793	5,904
Phase 2	84.1	\$ 12,582,662	\$ 10,077,373	3,544
Phase 3	256.3	\$ 31,270,062	\$ 26,458,091	3,473
Phase 4	-	\$ 4,314,820	\$ 4,314,820	-
Phase 5	-	\$ -	\$ -	-

Phase	Distribution Plant Mileage	Total Cost (without drops)	Passings	Cost per Passing (Distribution Only)
Total	<b>403.0</b>	\$ <b>49,040,000</b>	<b>12,920</b>	\$ <b>3,800</b>
High Density	63.0	\$ 8,190,000	5,900	\$ 1,390
Medium Density	84.0	\$ 10,077,000	3,540	\$ 2,840
Low Density	256.0	\$ 26,458,000	3,470	\$ 7,620
Backbone	-	\$ 4,315,000	-	#DIV/0!
Phase 5	-	\$ -	-	#DIV/0!

<b>Cost per Passing (Distribution Only)</b>	<b>Cost Per Plant Mile (Distribution Only)</b>	<b>Notes</b>	<b>Cost per Drop</b>
\$ 3,800	\$ 120,000	<b>Total Costs</b>	\$ 2,216
\$ 1,387	\$ 130,712	High Density	\$ 1,309
\$ 2,844	\$ 119,858	Medium Density	\$ 2,020
\$ 7,618	\$ 103,221	Low Density	\$ 3,959
#DIV/0!	#DIV/0!	Backbone	
#DIV/0!	#DIV/0!		

<b>Cost Per Plant Mile (Distribution Only)</b>
\$ 120,000
\$ 131,000
\$ 120,000
\$ 103,000
#DIV/0!
#DIV/0!

## FTTP Distribution and Access Electronics Cost Estimates by Phase

### **Combined GPON OLT / Active Ethernet Distribution Equipment (High Density)**

<b>Make</b>	<b>Model</b>	<b>Description</b>
Calix	E7-2	E7-2 chassis, 1 RU with redundant power supplies
Calix	GPON-8	OLT Line card with 8 GPON and 4 GE interfaces
Calix		10GE SFP+, 10KM, 1310 nm
Calix		10GE SFP+, 300m, 850 nm
Calix		GPON OIM
Calix		GE SFP, 10 km, 1310 nm
		1x32 PON splitter and jumper cables

Estimated In:

### **Combined GPON OLT / Active Ethernet Distribution Equipment (Medium Density)**

<b>Make</b>	<b>Model</b>	<b>Description</b>
Calix	E7-2	E7-2 chassis, 1 RU with redundant power supplies
Calix	GPON-8	OLT Line card with 8 GPON and 4 GE interfaces
Calix		10GE SFP+, 10KM, 1310 nm
Calix		10GE SFP+, 300m, 850 nm
Calix		GPON OIM
Calix		GE SFP, 10 km, 1310 nm
		1x32 PON splitter and jumper cables

Estimated In:

### **Combined GPON OLT / Active Ethernet Distribution Equipment (Low Density)**

<b>Make</b>	<b>Model</b>	<b>Description</b>
Calix	E7-2	E7-2 chassis, 1 RU with redundant power supplies
Calix	GPON-8	OLT Line card with 8 GPON and 4 GE interfaces
Calix		10GE SFP+, 10KM, 1310 nm
Calix		10GE SFP+, 300m, 850 nm
Calix		GPON OIM
Calix		GE SFP, 10 km, 1310 nm
		1x32 PON splitter and jumper cables

Estimated In:

### **Combined GPON OLT / Active Ethernet Distribution Equipment (Hub D)**

<b>Make</b>	<b>Model</b>	<b>Description</b>
Calix	E7-2	E7-2 chassis, 1 RU with redundant power supplies
Calix	GPON-8	OLT Line card with 8 GPON and 4 GE interfaces
Calix		10GE SFP+, 10KM, 1310 nm

Calix	10GE SFP+, 300m, 850 nm	
Calix	GPON OIM	
Calix	GE SFP, 10 km, 1310 nm	
	1x32 PON splitter and jumper cables	
		Estimated In:

***Combined GPON OLT / Active Ethernet Distribution Equipment (Hub E)***

<b><i>Make</i></b>	<b><i>Model</i></b>	<b><i>Description</i></b>	
Calix	E7-2	E7-2 chassis, 1 RU with redundant power supplies	
Calix	GPON-8	OLT Line card with 8 GPON and 4 GE interfaces	
Calix		10GE SFP+, 10KM, 1310 nm	
Calix		10GE SFP+, 300m, 850 nm	
Calix		GPON OIM	
Calix		GE SFP, 10 km, 1310 nm	
		1x32 PON splitter and jumper cables	
			Estimated In:

<i><b>Qty.</b></i>	<i><b>Unit List Price</b></i>	<i><b>Extended</b></i>		<i><b>Phase</b></i> <i><b>(1-4)</b></i>
		<i><b>Discount Price</b></i>		
9	\$ 800.00	\$ 4,320.00		1
18	\$ 11,000.00	\$ 118,800.00		1
	\$ 1,600.00	\$ -		1
18	\$ 900.00	\$ 9,720.00		1
144	\$ 1,500.00	\$ 129,600.00		1
11	\$ 150.00	\$ 990.00		1
144	\$ 1,200.00	\$ 103,680.00		1
Installation and Configuration:		\$ 91,777.50		1
Total:		\$ 458,887.50		

<i><b>Qty.</b></i>	<i><b>Unit List Price</b></i>	<i><b>Extended</b></i>		<i><b>Phase</b></i> <i><b>(1-4)</b></i>
		<i><b>Discount Price</b></i>		
5	\$ 800.00	\$ 2,400.00		2
10	\$ 11,000.00	\$ 66,000.00		2
	\$ 1,600.00	\$ -		2
10	\$ 900.00	\$ 5,400.00		2
80	\$ 1,500.00	\$ 72,000.00		2
6	\$ 150.00	\$ 540.00		2
80	\$ 1,200.00	\$ 57,600.00		2
Installation and Configuration:		\$ 50,985.00		2
Total:		\$ 254,925.00		

<i><b>Qty.</b></i>	<i><b>Unit List Price</b></i>	<i><b>Extended</b></i>		<i><b>Phase</b></i> <i><b>(1-5)</b></i>
		<i><b>Discount Price</b></i>		
5	\$ 800.00	\$ 2,400.00		3
10	\$ 11,000.00	\$ 66,000.00		3
	\$ 1,600.00	\$ -		3
10	\$ 900.00	\$ 5,400.00		3
80	\$ 1,500.00	\$ 72,000.00		3
6	\$ 150.00	\$ 540.00		3
80	\$ 1,200.00	\$ 57,600.00		3
Installation and Configuration:		\$ 50,985.00		3
Total:		\$ 254,925.00		

<i><b>Qty.</b></i>	<i><b>Unit List Price</b></i>	<i><b>Extended</b></i>		<i><b>Phase</b></i> <i><b>(1-5)</b></i>
		<i><b>Discount Price</b></i>		
	\$ 800.00	\$ -		1
	\$ 11,000.00	\$ -		1
	\$ 1,600.00	\$ -		1

\$	900.00	\$	-	1
\$	1,500.00	\$	-	1
\$	150.00	\$	-	1
\$	1,200.00	\$	-	1
Installation and Configuration:	\$		-	1
Total:	\$		-	

<i>Qty.</i>	<i>Unit List Price</i>	<i>Discount Price</i>	<i>Extended</i>	<i>Phase</i>
				(1-5)
\$	800.00	\$	-	1
\$	11,000.00	\$	-	1
\$	1,600.00	\$	-	1
\$	900.00	\$	-	1
\$	1,500.00	\$	-	1
\$	150.00	\$	-	1
\$	1,200.00	\$	-	1
Installation and Configuration:	\$		-	1
Total:	\$		-	

**Total Implementation: \$ 968,737.50**

**Annual Maintenance: \$ 145,000.00**

## FTTP Customer Premise Cost Estimates

### ***Standard Residential and Business ONT and installation***

<b><i>Make</i></b>	<b><i>Model</i></b>	<b><i>Description</i></b>	
Calix	100-04011	Gigacenter 844G Indoor ONT, GPON-only, 2 POTS, 4xGE and 802.11ac client access <i>(alternatively: 711GE outdoor ONT w/ enclosure and indoor residential WiFi gateway)</i>	
Calix	100-03893	Standalone UPS, 8 hour Indoor Cat5e drop	Estimated II

### ***Standard symmetrical GE Business ONT and installation***

<b><i>Make</i></b>	<b><i>Model</i></b>	<b><i>Description</i></b>	
Calix	744GE	Indoor/outdoor ONT, GPON or GE service, 2 POTS, 2xGE	
Calix		ONT enclosure Standalone UPS, 8 hour Indoor Cat5e drop	Estimated II

<i>Extended</i>			
<i>Qty.</i>	<i>Unit List Price</i>	<i>Discount Price</i>	
1 \$	280.00	\$	280.00
1 \$	50.00	\$	50.00
1 \$	200.00	\$	200.00
Installation and Provisioning:	\$		100.00
<b>Total:</b>	<b>\$</b>	<b>630.00</b>	<b>\$ 2,849,080.50</b> Total CPE costs for the take rate

<i>Extended</i>			
<i>Qty.</i>	<i>Unit List Price</i>	<i>Discount Price</i>	
1 \$	320.00	\$	320.00
1 \$	30.00	\$	30.00
1 \$	50.00	\$	50.00
1 \$	200.00	\$	200.00
Installation and Provisioning:	\$		100.00
<b>Total:</b>	<b>\$</b>	<b>700.00</b>	

## **Service Area / Segment Cost Breakdown**

<b>Estimated Take Rate (%):</b>	35%
<b>Standalone Segment Total:</b>	403.06

0.65  
0.65  
0.65



62-66

84.08

256.33

403.06







\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ 353,376.12	\$ 5,880,228.56	\$ -			3	
\$ 474,196.77	\$ 7,248,027.27	\$ -			13	
\$ 1,445,677.29	\$ 20,985,724.02	\$ -		2	29	
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ -	\$ -	\$ -				
\$ 2,927,330	\$ 34,113,980	\$ 2,201,939		2	45	0



\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ -			N/A	\$ -	
\$ 55,800.00	0	\$ 271,716.91	\$ 271,716.91		
\$ 241,800.00	0	\$ 233,069.52	\$ 233,069.52		
\$ 608,160.00	0	\$ 511,345.59	\$ 511,345.59		
\$ -	0	\$ -	\$ -		
\$ -	0	\$ -	\$ -		
\$ -	0	\$ -	\$ -		
\$ -	0	\$ -	\$ -		
\$ -	0	\$ -	\$ -		
\$ -	0	\$ -	\$ -		
\$ -	0	\$ -	\$ -		
\$ -	0	\$ -	\$ -		
\$ -			\$ -		
\$ -			\$ -		
\$ -			\$ -		
\$ 905,760.00	20	\$ 1,016,132	\$ 1,061,081		2



		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
		N/A	\$ -	\$ -
			\$ -	
24	\$ 242,645.40	\$ 962,645.40	\$ 2,704,272.16	
29	\$ 116,536.19	\$ 986,536.19	\$ 2,505,288.83	
	\$ 182,441.12	\$ 182,441.12	\$ 4,811,971.55	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
		\$ -		
		\$ -		
1	53 \$ 541,623	\$ 2,312,697	\$ 10,021,533	





## Backbone Network Design Metrics

Underground Route Mileage:	23.19
Aerial Route Mileage:	92.78
<b>Total Mileage</b>	<b>115.97</b>

Average Backbone Fiber Strand Count:	288	Single cable along all backbone routes, including over segments and multiple rings
Average Strands Terminated per Hub/FDC Location:	24	Per cable

Railroad Crossings:	2
Interstate Crossings:	0

Strands Terminated Per Lateral / MDU:	6	Redundant / ring sites get two "terminations"
---------------------------------------	---	---

% Intermediate Rock:	5%
% Hard Rock:	1%

% Aerial:	80%
% Underground:	20%

<b>Average make-ready cost per foot:</b>	\$	<b>0.25</b>
Make Ready Cost per move:	\$	350.00
Average moves per pole:		1.3
Average poles per mile:		35
% poles requiring make ready:		1%
% poles requiring replacement:		1%
Average pole replacement cost:		\$7,000

ents shared by

## Backbone Network Unit Pricing Estimates

### Unit Price Summary

<b>Item</b>	<b>Unit Price</b>	<b>Unit</b>
Pre-Engineering and Network Planning	\$ 910.00	mile
City/County/State Route Engineering and Permitting	\$ 9,720.00	mile
Quality Control/Quality Assurance	\$ 5,640.00	mile
Railroad Crossing Engineering and Fees	\$ 34,380.00	each
Bridge Crossing Engineering and Fees	\$ 18,600.00	each
Interstate Crossing Engineering and Fees	\$ 7,880.00	each
Gas Crossing engineering and Fees	\$ 2,940.00	each
Backbone Underground construction (One conduit, labor and materials)	\$ 117,227.00	mile
Shared Route Backbone Underground construction (Uses FTTP Distribution conduit, includes dedicated cable placement labor and materials)	\$ 21,912.00	mile
Backbone Aerial construction (New attachment, labor and materials)	\$ 44,904.23	mile
Shared Route Backbone Aerial construction (Uses FTTP distribution plant strand, includes dedicated cable placement labor and materials).	\$ 18,255.60	mile
Backbone Splice (New Construction)	\$ 2,247.43	each
Hub Site entrance, termination, and testing	\$ 15,537.28	each
Hub Shelter	\$ 150,000.00	each
Outdoor Equipment Enclosure	\$ 30,000.00	each
Lateral Splice and Fiber Termination	\$ 4,574.00	each

### Pre-Engineering and Network Design

<b>Description</b>	<b>Unit Price</b>	<b>Unit</b>	<b>Qty.</b>
Preliminary Design	\$ 155.00	Hour	1
Field Survey / Walk-outs	\$ 150.00	Hour	4
Network Architecture Planning	\$ 155.00	Hour	1
<b>Subtotal per mile:</b>			

### Engineering/Permitting (new construction)

<b>Description</b>	<b>Unit Price</b>	<b>Unit</b>	<b>Qty.</b>

CAD Design and City/State/County permit engineering	\$ 150.00	Hour	24
Splice schematics	\$ 130.00	Hour	12
Environmental review and permitting	\$ 150.00	Hour	20
As-Built drawings and fiber management databased development	\$ 130.00	Hour	12
<b>Subtotal per mile:</b>			

#### **Quality Assurance/Quality Control**

Description	Unit Price	Unit	Qty.
Project Management	\$ 160.00	Hour	24
Quality Assurance	\$ 150.00	Hour	12
<b>Subtotal per mile:</b>			

#### **Special Crossings**

Description	Unit Price	Unit	Qty.
Railroad crossing engineering	\$ 120.00	Hour	24
Railroad crossing application fees	\$ 3,500.00	Each	1
Railroad crossing license fees	\$ 10,000.00	Each	1
4" Steel encasement of conduit along Railroad ROW	\$ 18,000.00	Each	1
<b>Subtotal per crossing:</b>			

Description	Unit Price	Unit	Qty.
Bridge crossing engineering	\$ 120.00	Hour	30
Bridge attachment costs; materials and labor	\$ 15,000.00	Each	1
<b>Subtotal per crossing:</b>			

Description	Unit Price	Unit	Qty.
Interstate crossing engineering	\$ 120.00	Hour	24
Interstate crossing permit fees	\$ 5,000.00	Each	1
<b>Subtotal per crossing:</b>			

<i>Description</i>	<i>Unit Price</i>	<i>Unit</i>	<i>Qty.</i>
Gas crossing engineering	\$ 120.00	Hour	12
4" Steel encasement of conduit along gas ROW	\$ 1,500.00	Each	1
<b>Subtotal per crossing:</b>			

**Backbone Underground Construction (Two 2-inch conduits)**

<i>Description</i>	<i>Unit Price</i>	<i>Unit</i>	<i>Qty.</i>
Placement of 2-inch conduit using directional boring	\$ 14.00	Foot	5280
Placement of additional 2-inch conduit	\$ 1.75	Foot	5280
Intermediate rock construction adder	\$ 25.00	Foot	264
Hard rock construction adder	\$ 50.00	Foot	52.8
Pull-box placement, 24"x36"x36" Tier 22	\$ 1,050.00	Each	11
Install ground rod	\$ 55.00	Each	11
Install 288-count cable	\$ 2.40	Foot	5280
<b>Labor and Material Subtotal:</b>			

**Shared Route Backbone Underground Construction (common route with FTTP Distribution conduits)**

<i>Description</i>	<i>Unit Price</i>	<i>Unit</i>	<i>Qty.</i>
Placement of additional 2-inch conduit	\$ 1.75	Foot	5280
Install 288-count cable	\$ 2.40	Foot	5280
<b>Labor and Material Subtotal per mile:</b>			

**Backbone Aerial Construction (New Attachment)**

<i>Description</i>	<i>Unit Price</i>	<i>Unit</i>	<i>Qty.</i>
Cable and Strand Placement	\$ 2.00	FT	5280
Traffic control / work area protection	\$ 1.00	FT	5280
Tree Trimming	\$ 2.00	FT	5280
Utility pole make-ready (including pole owner fees)	\$ 0.25	FT	5280
<b>Labor Subtotal per mile:</b>			

<i>Description</i>	<i>Unit Price</i>	<i>Unit</i>	<i>Qty.</i>

288-count cable	\$ 2.05	FT	6072
Strand	\$ 0.50	FT	5280
Lashing wire	\$ 0.20	FT	5280
Miscellaneous hardware	\$ 0.20	FT	5280
<b>Material Subtotal per mile:</b>			

**Shared Route Backbone Aerial fiber (common route with FTTP Distribution conduit - includes on**

Description	Unit Price	Unit	Qty.
New cable placement	\$ 1.10	FT	5280
<b>Labor Subtotal per mile:</b>			

Description	Unit Price	Unit	Qty.
288-count cable	\$ 2.05	FT	6072
<b>Material Subtotal per mile:</b>			

**Backbone Splice (new construction)**

Description	Unit Price	Unit	Qty.
Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	\$ 1,230.07	each	1
Splicing labor	\$ 42.39	each	24
<b>Material Subtotal per enclosure:</b>			

**Hub Termination/Testing (per cable)**

Description	Unit Price	Unit	Qty.
Installation of fiber distribution center, fiber splice cassettes, and connector modules	\$ 10,750.00	each	1
Splicing labor	\$ 42.39	each	24
Fiber testing and reporting	\$ 13.09	each	288
<b>Material and Labor Subtotal:</b>			

**Hub Shelter**

Description	Unit Price	Unit	Qty.

Installation of Equipment Shelter, 12' x 8', w/ generator, A/C, and fire suppression)	\$ 150,000.00	each	1
<b>Material and Labor Subtotal:</b>			

**Outdoor Equipment Enclosure**

Description	Unit Price	Unit	Qty.
Installation of Outdoor Equipment Cabinet, Calix ODC-1000E, or equivalent, w/ rectifiers, backup batteries, and heat exchanger	\$ 30,000.00	each	1
<b>Material and Labor Subtotal:</b>			

**Backbone to Lateral Splice**

Description	Unit Price	Unit	Qty.
Splice enclosure	\$ 500.00	each	1
Splice enclosure installation labor	\$ 500.00	each	1
Splicing labor	\$ 15.00	each	24
<b>Material Subtotal per enclosure:</b>			

**Lateral Site Entrance/Termination**

Description	Unit Price	Unit	Qty.
Fiber termination panel, rack or wall-mount	\$ 250.00	each	1
Fiber connector modules	\$ 45.00	each	4
Preterminated fiber pigtails	\$ 20.00	each	24
Splicing labor	\$ 43.00	each	24
Fiber testing and reporting	\$ 28.00	each	24
Estimated cable placement labor and materials	\$ 600.00	each	1
<b>Material Subtotal per enclosure:</b>			

**Backbone Aerial Construction (Re-Use ADSS Attachment Space)**

Description	Unit Price	Unit	Qty.
Removal of ADSS Fiber	\$ 1.50	FT	5280
Strand and cable placement	\$ 2.00	FT	5280
Lash ADSS cable	\$ 0.75	FT	0

Traffic control / work area protection	\$ 1.00	FT	5280
Tree Trimming	\$ 1.00	FT	5280
Utility pole make-ready (including pole owner fees)		FT	5280
			<b>Labor Subtotal per mile:</b>

Description	Unit Price	Unit	Qty.
288-count cable	\$ 1.75	FT	6072
Strand	\$ 0.50	FT	5280
Lashing wire	\$ 0.20	FT	5280
Miscellaneous hardware	\$ 0.20	FT	5280
			<b>Material Subtotal per mile:</b>

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 155.00	
\$ 600.00	
\$ 155.00	
\$ 910.00	

<i>Extended Per Mile Cost</i>	<i>Comment</i>

\$ 3,600.00	
\$ 1,560.00	
\$ 3,000.00	
\$ 1,560.00	
<b>\$ 9,720.00</b>	

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 3,840.00	
\$ 1,800.00	
<b>\$ 5,640.00</b>	

<i>Extended Per Crossing Cost</i>	<i>Comment</i>
\$ 2,880.00	
\$ 3,500.00	Based on typical costs; specific costs vary between railway owners
\$ 10,000.00	Based on typical costs; specific costs vary between railway owners
\$ 18,000.00	Based on typical railway ROW lengths and typical steel encasement costs
<b>\$ 34,380.00</b>	

<i>Extended Per Crossing Cost</i>	<i>Comment</i>
\$ 3,600.00	Based on typical costs; specific costs vary based on conditions
\$ 15,000.00	Based on typical costs; specific costs vary based on conditions
<b>\$ 18,600.00</b>	

<i>Extended Per Crossing Cost</i>	<i>Comment</i>
\$ 2,880.00	Based on typical costs; specific costs vary based on conditions
\$ 5,000.00	
<b>\$ 7,880.00</b>	

<i>Extended Per Crossing Cost</i>	<i>Comment</i>
\$ 1,440.00	Based on typical costs; specific costs vary based on conditions
\$ 1,500.00	Based on typical railway ROW lengths and typical steel encasement costs
<b>\$ 2,940.00</b>	

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 73,920.00	Includes test pitting, standard traffic control, concrete/asphalt restoration, and conduit placement
\$ 9,240.00	
\$ 6,600.00	>5,000 psi
\$ 2,640.00	>25,000 psi
\$ 11,550.00	
\$ 605.00	
\$ 12,672.00	
<b>\$ 117,227.00</b>	

uit - includes only additional cable/conduit and incremental labor)

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 9,240.00	Includes placement of mule tape
\$ 12,672.00	
<b>\$ 21,912.00</b>	

---

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 10,560.00	Includes cable and strand placement, guying, grounding/bonding, tree trimming, riser construction, and cable placement/lashing
\$ 5,280.00	
\$ 10,560.00	
\$ 1,304.63	Includes utility pole owner make-ready analysis and minimal make-ready construction (no pole replacements)
<b>\$ 27,704.63</b>	

<i>Extended Per Mile Cost</i>	<i>Comment</i>

\$ 12,447.60	Typical price for Zero Water Peak singlemode cable, including slack loops
\$ 2,640.00	
\$ 1,056.00	
\$ 1,056.00	Ground rods, guy wires, clamps, etc.
<b>\$ 17,199.60</b>	

**ly additional cable and incremental labor)**

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 5,808.00	
<b>\$ 5,808.00</b>	

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 12,447.60	Typical price for Zero Water Peak singlemode cable, including slack loops
<b>\$ 12,447.60</b>	

<i>Per Splice Enclosure / Location</i>	<i>Comment</i>
\$ 1,230.07	Includes materials and labor for enclosure placement and assembly - Includes splice trays and related hardware.
\$ 1,017.36	12-fiber mass fusion ribbon splice
<b>\$ 2,247.43</b>	

<i>Per Splice Enclosure / Location</i>	<i>Comment</i>
\$ 10,750.00	e.g. Corning CCH-04U, CCH-RM24-B3-P03-RJ
\$ 1,017.36	12-fiber mass fusion ribbon splice
\$ 3,769.92	Bi-directional OTDR/power meter testing and reporting included.
<b>\$ 15,537.28</b>	

<i>Per Splice Enclosure / Location</i>	<i>Comment</i>

\$ 150,000.00	Includes equipment racks, cable management, environmental monitoring, and UPS.
\$ 150,000.00	

<i>Per Splice Enclosure / Location</i>	<i>Comment</i>
\$ 30,000.00	Includes concrete pad and power connections.
\$ 30,000.00	

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 500.00	Includes splice trays and related hardware
\$ 500.00	
\$ 360.00	Assumes use of a "ring cut" avoiding the need to break straight-through strands; up to 12-strands each spliced to the backbone.
\$ 1,360.00	

<i>Per Splice Enclosure / Location</i>	<i>Comment</i>
\$ 250.00	e.g. Corning PWH-04P or PCH-01U
\$ 180.00	Six strand modules with connectors
\$ 480.00	Assumes the use of preterminated pigtail cables
\$ 1,032.00	
\$ 672.00	
\$ 600.00	Includes expected labor and material costs for EMT, core drilling, plenum innerduct, etc.
\$ 3,214.00	

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 7,920.00	Remove the ADSS from its existing location in the comm space
\$ 10,560.00	Includes strand placement, guying, grounding/bonding, riser construction, and cable placement/lashing
\$ -	Lash ADSS fiber to strand and fiber.

\$ 5,280.00	
\$ 5,280.00	
\$ -	Includes utility pole owner make-ready analysis and minimal make-ready construction (no pole replacements)
<b>\$ 21,120.00</b>	

<i>Extended Per Mile Cost</i>	<i>Comment</i>
\$ 10,626.00	Typical price for Zero Water Peak singlemode cable, including slack loops
\$ 2,640.00	
\$ 1,056.00	
\$ 1,056.00	Ground rods, guy wires, clamps, etc.
<b>\$ 15,378.00</b>	6.9125

## Master Distribution Plant Price List

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

Description	Unit	Unit Price
Installation of Ground Rod	EA	\$ 55.00
Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	\$ 9.50
Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	\$ 10.00
Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	\$ 13.00
Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	\$ 34.29
Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	\$ 24.74
Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	\$ 37.40
Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	\$ 20.00
Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	\$ 20.00
Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	\$ 22.00
Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	\$ 1.50
Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	\$ 1.75
Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	\$ 1.50
Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	\$ 1.75
Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	\$ 1.50
Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	\$ 1.75
Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	\$ 1.50
Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	\$ 1,425.00
Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	\$ 1,050.00
Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	\$ 450.00
Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	\$ 525.00
U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	\$ 0.90
U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	\$ 1.30
U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	\$ 1.23
U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	\$ 1.40
U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	\$ 2.00
U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	\$ 2.50
Removal of Fiber Optic Cable from Conduit	FT	\$ 0.33
Rock Bore Adder Unit (Hard Rock)	FT	\$ 50.00
Rock Bore Adder Unit (Intermediate Rock)	FT	\$ 30.00
Rock Removal Excavation Adder Unit	FT	\$ 23.50
Install Additional 1.25" ID in Conduit	FT	\$ 0.52
Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	\$ 4.40
Aerial Feeder Cable, outdoor 12-count, material only	FT	\$ 0.25
Aerial Feeder Cable, outdoor 24-count, material only	FT	\$ 0.58
Aerial Feeder Cable, outdoor 48-count, material only	FT	\$ 0.75
Aerial Feeder Cable, outdoor 144-count, material only	FT	\$ 1.75
Aerial Feeder Cable, outdoor 288-count, material only	FT	\$ 2.05

**Distrubtion Splicing**

Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fussion splice	EA	\$ 1,210.00
Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	\$ 850.00
Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	\$ 970.00
Fiber Splicing, Individual Strand (per strand)	EA	\$ 14.23
Mass Fusion Splices (per ribbon)	EA	\$ 42.39

**Distribution Termination and Testing**

OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	\$ 14.26
OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	\$ 19.75
Final Acceptance testing of Terminated cable (per strand)	EA	\$ 26.18
Installation of Backbone Termination Panel, 288-strands	EA	\$ 10,750.00

**Lateral and Service Drops**

Fiber Splicing, Individual Strand (per strand)	EA	\$ 14.23	
Mass Fusion Splices (per ribbon)	EA	\$ 42.39	
Lateral Termination Panel, rack-mount, 12-strands	EA	\$ 926.85	
Lateral Termination Panel, wall-mount, 12-strands	EA	\$ 974.75	
Lateral Termination Panel, rack-mount, 24-strands	EA	\$ 1,384.83	
Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	\$ 9.64	
Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	\$ 5.60	
Installation of Direct buried drop cable - Trench/Plow	FT	\$ 6.00	Excavation labor only
Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	\$ 384.99	Cable material and lab
Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	\$ 547.97	Cable material and lab



or for drop placement in conduit or aerial attachment - excavation separate.  
or for drop placement in conduit or aerial attachment - excavation separate.

## FTTP Distribution Plant Design Metrics

	<u>GIS and Field Survey Metrics</u>	High	Medium
Service Area:	A	B	
Total Structures/Addresses (quantity):	5929	3544	
Total Street Distance (FT):	313,254	421,786	
Viable Aerial Routes (%):	35%	35%	
Access handhole design density (passings per handhole):	4	3	
Multi-Tenant Business/MDU Laterals (quantity):	25		
Average MDU Lateral Length (FT):	300		
Average home/business set-back from RoW (FT):	24.7	124.2	
Average moves per pole:	1.3	1.3	
Average poles per mile:	45.0	40.0	
% poles requiring make ready:	8%	8%	
% poles requiring replacement:	18%	18%	
Downtown / historic underground open cut route (FT):	593		
Average street width / crossing distance (FT):	20.0	22.0	

### Extrapolated Service Area Metrics

	<u>Service Area:</u>	A	B
Total Distribution Plant Route (FT)	330,820	443,929	
Total Passings (not including MDUs w/ 20+ units):	5,904	3,544	
Total Tap Housings:	1408	1010	
Total Tap Ports:	8447	4041	
Splice cases:	154	181	
Total Distribution cable, including slack (FT):	522,255	613,511	

### Sample Design Totals

	<u>Service Area:</u>	A	B
Sample Design Passings:	1,395	769	
Sample Design Street Distance (FT):	69,421	86,430	

Low

C	D	E	F	G	H	I
3473						
1,371,068						
35%						
2						
310.541254						
1.3						
35.0						
8%						
18%						
24						

C	D	E	F	G	H	I
1,353,400	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
3,473	-	-	-	-	-	-
1434	N/A	N/A	N/A	N/A	N/A	N/A
5737	N/A	N/A	N/A	N/A	N/A	N/A
443	N/A	N/A	N/A	N/A	N/A	N/A
1,702,163	N/A	N/A	N/A	N/A	N/A	N/A

C	D	E	F	G	H	I
371	-	-	-	-	-	-
127,144	-	-	-	-	-	-

<b>J</b>	<b>K</b>	<b>L</b>	<b>Total</b>	<b>Citywide Density Averages</b>	
			12946	Street miles	Passings/mi
			2,106,108	398.88	32.46
			N/A		
			25		
			N/A		
			N/A		



<b>J</b>	<b>K</b>	<b>L</b>	<b>Total</b>
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
-	-	-	12,921
N/A	N/A	N/A	3,852
N/A	N/A	N/A	18,225
N/A	N/A	N/A	778
N/A	N/A	N/A	2,837,930

<b>J</b>	<b>K</b>	<b>L</b>	<b>Total</b>	<b>Sample Density Averages</b>	
-	-	-	2,535	Street Miles	Passings/mi
-	-	-	282,995	53.60	47.30

## Service Area A Design Metrics

Aerial Street Footage:	109,639
Underground Street Footage:	203,615
<b>Total Street Footage</b>	<b>313,254</b>

Business laterals:	25
Average Business lateral length:	300
Total Business Lateral conduit path:	7500

Total passings:	5904
Passing density per street mile:	99.5
Total standard FTTP drops:	2067

Dependent on take-rate

Total FDC's in Service Area:	24
Average feeder legs per FDC:	4
Average feeder fiber strand count:	96
Total feeder fiber cable:	177,167
Total feeder fiber termination panels:	2

per cable

FT

288-count panels

Total distribution aerial strand footage:	115,787
Total distribution conduit footage:	215033.1256
Total distribution route footage:	330,820

FT

FT

FT

Total splices (distribution plant):	8597
Total Splice Cases:	154
Total tap ports:	8447
Number of taps housings:	1408
Average tap ports per housing:	6
Hub/FDC termination splices:	8597

Average tap stub footage:	245
Total cable placement footage:	522,255
Average drop cable length:	234
Total dedicated U/G drop cable path:	300,628
Total aerial drop cable path:	133,109

FT

FT

FT

FT

FT

Large handholes:	450
Small handholes:	0

Downtown / historic underground open cut route footage:	592.9
Intermediate Rock footage:	10,752
Hard Rock footage:	2,150

FT

FT

FT

**Average make-ready cost per foot: \$ 11.05**

Make Ready Cost per move:	\$ 350.00
Average moves per pole:	1.3
Average poles per mile:	45.00
% poles requiring make ready:	8%
% poles requiring replacement:	18%
Average pole replacement cost:	\$ 7,000

**Aerial Cable placement cost per foot \$ 4.40**

Cable and strand placement	\$ 2.00	per foot for new attachments, independent of cable strand count or number of cables in single attachment
Tree Trimming	\$ 0.50	
Work-area protection	\$ 1.00	
Strand	\$ 0.50	
Lashing wire	\$ 0.20	
Miscellaneous materials	\$ 0.20	

Notes:

% Aerial:	35%
% Underground:	65%

% Intermediate Rock:	5%
% Hard Rock:	1%

### **Sample Design**

Sample design addresses/passings:	1395
Sample design passing density per street mile:	106.1

Sample design feeder fiber path footage:	32101.5
Sample design total distribution conduit/strand footage:	73314.5
Sample design street footage:	69421.5
Sample design access-only path footage:	41,213
Feeder Fiber multiplier:	0.492
Distribution conduit/strand multiplier:	1.056

Sample design average access-only branches per splice:	3
Sample design number of feeder splice cases:	34
Sample design number of tap housings:	312
Sample design number of tap housings along feeder paths:	102
Splice case multiplier:	2.585943844
Tap housing multiplier:	23.72983763

Suburban or urban (grid) street area:	Urban
Average tap stub cable footage along feeder paths:	271
Average tap stub cable footage along access-only paths:	232
Average building/home set-back from RoW:	25
Average property frontage:	100

Sample design roadway intersections along feeder route:	72
Large handholes per feeder fiber path mile:	15.40
Small handholes per distribution fiber path mile:	0.00
Number of street crossings for access handholes on feeder route:	102
Average street crossing distance:	20
Feeder fiber street crossing path distance:	2040
Access handhole design density (passings per handhole):	4



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area A Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	450
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	215033
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	593
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	450
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	0
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	115159
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	0
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	2150
	Rock Bore Adder Unit (Intermediate Rock)	FT	10752
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	115787
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	62009
	Aerial Feeder Cable, outdoor 288-count, material only	FT	0
	Utility pole make-ready cost	FT	115787
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	1408


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	154
10	Fiber Splicing, Individual Strand (per strand)	EA	8597
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	8447
15	Installation of Backbone Termination Panel, 288-strands	EA	2

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	25
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	25
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	7500
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	1250
	Installation of Direct buried drop cable - Trench/Plow	FT	300628
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	2067
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0
21c	Installation of Individual FTTP Service Drop Cable, SC-APC, 500+ foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ 24,750.00
\$ 9.50	N/A
\$ 10.00	\$ 2,150,331.26
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ 14,668.35
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	\$ 472,500.00
\$ 450.00	\$ -
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ 230,317.41
\$ 2.50	\$ -
\$ 0.33	N/A
\$ 50.00	\$ 107,516.56
\$ 30.00	\$ 322,549.69
\$ 23.50	N/A
\$ 0.52	N/A
\$ 4.40	\$ 509,463.10
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ 108,514.94
\$ 2.05	\$ -
\$ 11.05	\$ 1,279,315.52
\$ 469.01	\$ 660,301.74

	\$	-
	\$	-

**ction Subtotal:** \$ **5,880,228.56**

\$ 1,210.00	N/A
\$ 850.00	N/A
\$ 970.00	\$ 149,380.00
\$ 14.23	\$ 122,336.91
\$ 42.39	N/A

**icing Subtotal:** \$ **271,716.91**

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	\$ 221,145.40
\$ 10,750.00	\$ 21,500.00

**sting Subtotal:** \$ **242,645.40**

\$ 14.23	N/A
\$ 42.39	\$ 1,059.75
\$ 926.85	N/A
\$ 974.75	\$ 24,368.75
\$ 1,384.83	N/A
\$ 9.64	\$ 72,300.00
\$ 5.60	\$ 7,000.00
\$ 6.00	\$ 1,803,769.33
\$ 384.99	\$ 795,774.33
\$ 547.97	\$ -
\$ 474.89	\$ -

**rops Subtotal:** \$ **2,704,272.16**

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial atta

Cable material and labor for drop placement in conduit or aerial atta

**Total:** \$ **9,098,863.03**



achment - excavation seperate.

achment - excavation seperate.

## Service Area B Design Metrics

Aerial Street Footage:	147,625
Underground Street Footage:	274,161
<b>Total Street Footage</b>	<b>421,786.2</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	3544
Passing density per street mile:	44.4
Total standard FTTP drops:	1241

Dependent on take-rate

Total FDC's in Service Area:	29
Average feeder legs per FDC:	2
Average feeder fiber strand count:	72
Total feeder fiber cable:	317,351
Total feeder fiber termination panels:	1

FT  
Per feeder cable  
288-count panels

Total distribution aerial strand footage:	155,375
Total distribution conduit footage:	288,554
Total distribution route footage:	443,929

FT  
FT  
FT

Total splices (distribution plant):	4041
Total Splice Cases:	181
Total tap ports:	4041
Number of taps housings:	1010
Average tap ports per housing:	4
Hub/FDC termination splices:	4041

Average tap stub footage:	293
Total cable placement footage:	613,511
Average drop cable length:	354
Total dedicated U/G drop cable path:	304,210
Total aerial drop cable path:	131,970

Large handholes:	310
Small handholes:	316

Downtown / historic underground open cut route footage:	0
Intermediate Rock footage:	14,428
Hard Rock footage:	2,886

FT  
FT  
FT

**Average make-ready cost per foot:** \$ **9.82**

Make Ready Cost per move:	\$ 350.00
Average moves per pole:	1.3
Average poles per mile:	40
% poles requiring make ready:	8%
% poles requiring replacement:	18%
Average pole replacement cost:	\$ 7,000

**Aerial Cable placement cost per foot**

**\$ 4.40**

per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Cable and strand placement	\$ 2.00
Tree Trimming	\$ 0.50
Work-area protection	\$ 1.00
Strand	\$ 0.50
Lashing wire	\$ 0.20
Miscellaneous materials	\$ 0.20

Notes:

% Aerial:	35%
% Underground:	65%

% Intermediate Rock:	5%
% Hard Rock:	1%

### **Sample Design**

Sample design addresses/passings:	769
Sample design passing density per street mile:	47.0

Sample design feeder fiber path footage:	54523.5
Sample design total distribution conduit/strand footage:	90967.1
Sample design street footage:	86429.8
Sample design access-only path footage:	36,444
Feeder Fiber multiplier:	0.654
Distribution conduit/strand multiplier:	1.052

Sample design average access-only branches per splice:	3
Sample design number of feeder splice cases:	37
Sample design number of tap housings:	207
Sample design number of tap housings along feeder paths:	92
Splice case multiplier:	2.260332204
Tap housing multiplier:	12.64564233

Suburban or urban (grid) street area:	Suburban
Average tap stub cable footage along feeder paths:	424
Average tap stub cable footage along access-only paths:	189
Average building/home set-back from RoW:	124
Average property frontage:	169

Sample design roadway intersections along feeder route:	47
Large handholes per distribution path mile:	5.92
Small handholes per distribution fiber path mile:	3.75
Number of street crossings for access handholes on feeder route:	92
Average street crossing distance:	22
Feeder fiber street crossing path distance:	2024
Access handhole design density (passings per handhole):	3



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area B Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	626
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	288554
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	310
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	316
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	206278
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	0
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	2886
	Rock Bore Adder Unit (Intermediate Rock)	FT	14428
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	155375
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	111073
	Aerial Feeder Cable, outdoor 288-count, material only	FT	0
	Utility pole make-ready cost	FT	155375
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	1010


### Conduit/Fiber OSP Construction

#### Distribution Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	181
10	Fiber Splicing, Individual Strand (per strand)	EA	4041
11	Mass Fusion Splices (per ribbon)	EA	N/A

Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	4040.73
15	Installation of Backbone Termination Panel, 288-strands	EA	1

Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	304210
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	1241
21c	Installation of Individual FTTP Service Drop Cable, SC-APC, 500+ foot	EA	0

Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ 34,430.00
\$ 9.50	N/A
\$ 10.00	\$ 2,885,537.77
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	\$ 325,500.00
\$ 450.00	\$ 142,200.00
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ 412,556.94
\$ 2.50	\$ -
\$ 0.33	N/A
\$ 50.00	\$ 144,276.89
\$ 30.00	\$ 432,830.67
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 4.40	\$ 683,650.49
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ 194,377.79
\$ 2.05	\$ -
\$ 9.82	\$ 1,525,971.92
	\$ -
\$ 461.99	\$ 466,694.81

	\$ -
	\$ -

**ction Subtotal:** \$ **7,248,027.27**

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	\$ 175,570.00
\$ 14.23	\$ 57,499.52
\$ 42.39	N/A

**icing Subtotal:** \$ **233,069.52**

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	\$ 105,786.19
\$ 10,750.00	\$ 10,750.00

**sting Subtotal:** \$ **116,536.19**

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	\$ 1,825,258.06
\$ 384.99	\$ -
\$ 547.97	\$ 680,030.77
\$ 474.89	\$ -

**rops Subtotal:** \$ **2,505,288.83**

Excavation labor only - no cable material.

Cable material and labor for basic aerial/conduit placement - no digging.

Cable material and labor for basic aerial/conduit placement - no digging.

**Total:** \$ **10,102,921.82**

## Service Area C Design Metrics

Aerial Street Footage:	479,874
Underground Street Footage:	891,194
<b>Total Street Footage</b>	<b>1,371,068.2</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	3473
Passing density per street mile:	13.4
Total standard FTTP drops:	1216

Dependent on take-rate

Total FDC's in Service Area:	7
Average feeder legs per FDC:	4
Average feeder fiber strand count:	216
Total feeder fiber cable:	1,069,404
Total feeder fiber termination panels:	3

FT  
Per feeder cable  
288-count panels

Total distribution aerial strand footage:	473,690
Total distribution conduit footage:	879,710
Total distribution route footage:	1,353,400

FT  
FT  
FT

Total splices (distribution plant):	5737
Total Splice Cases:	443
Total tap ports:	5737
Number of taps housings:	1434
Average tap ports per housing:	4
Hub/FDC termination splices:	5737

Average tap stub footage:	441
Total cable placement footage:	1,702,163
Average drop cable length:	887
Total dedicated U/G drop cable path:	651,764
Total aerial drop cable path:	356,057

Large handholes:	643
Small handholes:	365

Downtown / historic underground open cut route footage:	0
Intermediate Rock footage:	43,986
Hard Rock footage:	8,797

FT  
FT  
FT

**Average make-ready cost per foot:** \$ **8.66**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	1.3
Average poles per mile:	35
% poles requiring make ready:	8%
% poles requiring replacement:	18%
Average pole replacement cost:	\$ 7,000

**Aerial Cable placement cost per foot**

**\$ 4.40**

per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.00
Tree Trimming	\$ 0.50
Work-area protection	\$ 1.00
Strand	\$ 0.50
Lashing wire	\$ 0.20
Miscellaneous materials	\$ 0.20

Notes:

% Aerial:	35%
% Underground:	65%

% Intermediate Rock:	5%
% Hard Rock:	1%

### **Sample Design**

Sample design addresses/passings:	371
Sample design passing density per street mile:	15.4

Sample design feeder fiber path footage:	84626.5
Sample design total distribution conduit/strand footage:	125505.6
Sample design street footage:	127144.0567
Sample design access-only path footage:	40,879
Feeder Fiber multiplier:	0.678
Distribution conduit/strand multiplier:	0.987

Sample design average access-only branches per splice:	2
Sample design number of feeder splice cases:	41
Sample design number of tap housings:	133
Sample design number of tap housings along feeder paths:	67
Splice case multiplier:	1.702635622
Tap housing multiplier:	5.523183845

Suburban or urban (grid) street area:	Suburban
Average tap stub cable footage along feeder paths:	593
Average tap stub cable footage along access-only paths:	287
Average building/home set-back from RoW:	311
Average property frontage:	514

Sample design roadway intersections along feeder route:	45
Large handholes per distribution path mile:	3.65
Small handholes per distribution fiber path mile:	1.42
Number of street crossings for access handholes on feeder route:	67
Average street crossing distance:	24
Feeder fiber street crossing path distance:	1608
Access handhole design density (passings per handhole):	2



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area C Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	1008
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	879710
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	643
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	365
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	695113
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	8797
	Rock Bore Adder Unit (Intermediate Rock)	FT	43986
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	473690
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		374291
	Utility pole make-ready cost	FT	473690
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	1434


### Conduit/Fiber OSP Construction

#### Distribution Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	443
10	Fiber Splicing, Individual Strand (per strand)	EA	5737
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	5736.86
15	Installation of Backbone Termination Panel, 288-strands	EA	3

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	651764
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0
21c	Installation of Individual FTTP Service Drop Cable, SC-APC, 500+ foot	EA	1216

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ 55,440.00
\$ 9.50	N/A
\$ 10.00	\$ 8,797,100.13
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	\$ 675,150.00
\$ 450.00	\$ 164,250.00
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	\$ 1,737,781.48
\$ 0.33	N/A
\$ 50.00	\$ 439,855.01
\$ 30.00	\$ 1,319,565.02
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 4.40	\$ 2,084,236.03
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	\$ 767,297.36
\$ 8.66	\$ 4,103,339.69
	\$ -
\$ 586.88	\$ 841,709.31

	\$	-
	\$	-

**Excavation Subtotal:** \$ 20,985,724.02

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	\$ 429,710.00
\$ 14.23	\$ 81,635.59
\$ 42.39	N/A

**Excavating Subtotal:** \$ 511,345.59

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	\$ 150,191.12
\$ 10,750.00	\$ 32,250.00

**Stringing Subtotal:** \$ 182,441.12

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	\$ 3,910,586.75
\$ 384.99	\$ -
\$ 547.97	\$ -
\$ 741.27	\$ 901,384.80

**Cablerops Subtotal:** \$ 4,811,971.55

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ 26,491,482.27



- excavation seperate.
- excavation seperate.

## Service Area D Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	0
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Dependent on take-rate  
Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 10,000

**Aerial Cable placement cost per foot****\$ 5.90**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.00
Tree Trimming	\$ 2.00
Work-area protection	\$ 1.00
Strand	\$ 0.50
Lashing wire	\$ 0.20
Miscellaneous materials	\$ 0.20

Notes:

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	Suburban
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area D Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.90	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Casing Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial a

Cable material and labor for drop placement in conduit or aerial a

**rops Subtotal:** \$ -

**Total:** \$ -



ttachment - excavation seperate.  
ttachment - excavation seperate.

## Service Area E Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	0
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A FT
Total feeder fiber termination panels:	- 288-count panels

Total distribution aerial strand footage:	#DIV/0! FT
Total distribution conduit footage:	#DIV/0! FT
Total distribution route footage:	#DIV/0! FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0 FT
Intermediate Rock footage:	#DIV/0! FT
Hard Rock footage:	#DIV/0! FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 10,000

**Aerial Cable placement cost per foot****\$ 5.90**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.00
Tree Trimming	\$ 2.00
Work-area protection	\$ 1.00
Strand	\$ 0.50
Lashing wire	\$ 0.20
Miscellaneous materials	\$ 0.20

Note:

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	Suburban
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area E Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.90	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Service Area F Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 12,000

**Aerial Cable placement cost per foot****\$ 5.37**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.57
Tree trimming	\$ 1.00
Work-area protection	\$ 1.00
Strand	\$ 0.25
Lashing wire	\$ 0.05
Miscellaneous materials	\$ 0.50

Notes:

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area F Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.37	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Service Area G Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 12,000

**Aerial Cable placement cost per foot****\$ 5.37**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.57
Tree trimming	\$ 1.00
Work-area protection	\$ 1.00
Strand	\$ 0.25
Lashing wire	\$ 0.05
Miscellaneous materials	\$ 0.50

Notes:

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area G Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.37	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Service Area H Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 12,000

**Aerial Cable placement cost per foot****\$ 5.37**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.57
Tree trimming	\$ 1.00
Work-area protection	\$ 1.00
Strand	\$ 0.25
Lashing wire	\$ 0.05
Miscellaneous materials	\$ 0.50

**Notes:**

- Total Service Area street footage adjusted to exclude shopping mall/center parking lot roads.

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0

---

dways.

---

Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area H Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.37	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Service Area I Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 12,000

**Aerial Cable placement cost per foot****\$ 5.37**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.57
Tree trimming	\$ 1.00
Work-area protection	\$ 1.00
Strand	\$ 0.25
Lashing wire	\$ 0.05
Miscellaneous materials	\$ 0.50

**Notes:**

- Aerial labor cost includes additional \$1.75 per foot for tree trimming.

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area I Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.37	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Service Area J Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 12,000

**Aerial Cable placement cost per foot****\$ 5.37**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.57
Tree trimming	\$ 1.00
Work-area protection	\$ 1.00
Strand	\$ 0.25
Lashing wire	\$ 0.05
Miscellaneous materials	\$ 0.50

Notes:

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area J Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.37	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Service Area K Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 12,000

**Aerial Cable placement cost per foot****\$ 5.37**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.57
Tree trimming	\$ 1.00
Work-area protection	\$ 1.00
Strand	\$ 0.25
Lashing wire	\$ 0.05
Miscellaneous materials	\$ 0.50

Notes:

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area K Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.37	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Service Area L Design Metrics

Aerial Street Footage:	-
Underground Street Footage:	-
<b>Total Street Footage</b>	<b>-</b>

Business laterals:	0
Average Business lateral length:	0
Total Business Lateral conduit path:	0

Total passings:	0
Passing density per street mile:	#DIV/0!
Total standard FTTP drops:	0

Total FDC's in Service Area:	
Average feeder legs per FDC:	
Average feeder fiber strand count:	288
Total feeder fiber cable:	N/A
Total feeder fiber termination panels:	-

Per feeder cable  
FT  
288-count panels

Total distribution aerial strand footage:	#DIV/0!	FT
Total distribution conduit footage:	#DIV/0!	FT
Total distribution route footage:	#DIV/0!	FT

Total splices (distribution plant):	0
Total Splice Cases:	N/A
Total tap ports:	N/A
Number of taps housings:	N/A
Average tap ports per housing:	N/A
Hub/FDC termination splices:	N/A

Average tap stub footage:	N/A
Total cable placement footage:	N/A
Average drop cable length:	500
Total dedicated U/G drop cable path:	N/A
Total aerial drop cable path:	-

Large handholes:	N/A
Small handholes:	N/A

Downtown / historic underground open cut route footage:	0	FT
Intermediate Rock footage:	#DIV/0!	FT
Hard Rock footage:	#DIV/0!	FT

**Average make-ready cost per foot:**

Make Ready Cost per move:	\$ 450.00
Average moves per pole:	0
Average poles per mile:	0
% poles requiring make ready:	0
% poles requiring replacement:	0
Average pole replacement cost:	\$ 12,000

**Aerial Cable placement cost per foot****\$ 5.37**per foot for new attachments,  
independent of cable strand  
count or number of cables in  
single attachment

Strand and cable placement	\$ 2.57
Tree trimming	\$ 1.00
Work-area protection	\$ 1.00
Strand	\$ 0.25
Lashing wire	\$ 0.05
Miscellaneous materials	\$ 0.50

Notes:

% Aerial:	0%
% Underground:	100%

% Intermediate Rock:	
% Hard Rock:	

### **Sample Design**

Sample design addresses/passings:	
Sample design passing density per street mile:	#DIV/0!

Sample design feeder fiber path footage:	
Sample design total distribution conduit/strand footage:	
Sample design street footage:	
Sample design access-only path footage:	-
Feeder Fiber multiplier:	#DIV/0!
Distribution conduit/strand multiplier:	#DIV/0!

Sample design average access-only branches per splice:	
Sample design number of feeder splice cases:	
Sample design number of tap housings:	
Sample design number of tap housings along feeder paths:	
Splice case multiplier:	#DIV/0!
Tap housing multiplier:	N/A

Suburban or urban (grid) street area:	
Average tap stub cable footage along feeder paths:	#DIV/0!
Average tap stub cable footage along access-only paths:	#DIV/0!
Average building/home set-back from RoW:	0
Average property frontage:	#DIV/0!

Sample design roadway intersections along feeder route:	
Large handholes per distribution path mile:	#DIV/0!
Small handholes per distribution fiber path mile:	#DIV/0!
Number of street crossings for access handholes on feeder route:	0
Average street crossing distance:	0
Feeder fiber street crossing path distance:	0
Access handhole design density (passings per handhole):	0



Not including large MDU / multi-tenant businesses

Path from FDC to splice points for tap stubs

Path from FDC to taps ports (all distribution paths)

Path with no feeder fiber - tap stub cables only

Feeder fiber miles per street mile

Distribution path miles per street mile

Splice cases per street mile

Tap housings per street mile

FT

FT

Handholes along feeder fiber paths

Small Handholes along all distribution fiber paths

FT



## Service Area L Construction Unit Pricing

(Labor and Material, unless otherwise noted)

### Backbone and Distribution Conduit and Fiber OSP Construction

	Description	Unit	Quantity
1	Installation of Ground Rod	EA	0
2a-1.25	Installation of Conduit using Directional Boring, 1.25-inch SDR 11	FT	N/A
2a-2	Installation of Conduit using Directional Boring, 2-inch SDR 11	FT	#DIV/0!
2a-4	Installation of Conduit using Directional Boring, 4-inch SDR 11	FT	N/A
2b-1.25	Installation of Conduit Under Existing Pavement - Open Cut, 1.25-inch SDR 11	FT	N/A
2b-2	Installation of Conduit Under Existing Pavement - Open Cut, 2-inch SDR 11 (adder cost - unit price less standard directional bore price)	FT	0
2b-4	Installation of Conduit Under Existing Pavement - Open Cut, 4-inch SDR 11	FT	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	N/A
2c-2	Installation of Conduit in Unpaved Right-of-Way - Trench, 2-inch SDR 11	FT	N/A
2c-4	Installation of Conduit in Unpaved Right-of-Way - Trench, 4-inch SDR-11	FT	N/A
3a-1.25	Installation of Additional Conduit - Directional Boring, 1.25-inch SDR 11	FT	N/A
3a-2	Installation of Additional Conduit - Directional Boring, 2-inch SDR 11	FT	N/A
3b-1.25	Installation of Additional Conduit - Open Cut, 1.25-inch SDR 11	FT	N/A
3b-2	Installation of Additional Conduit - Open Cut, 2-inch SDR 11	FT	N/A
3c-1.25	Installation of Additional Conduit - Open Trench, 1.25-inch SDR 11	FT	N/A
3c-2	Installation of Additional Conduit - Open Trench, 2-inch SDR 11	FT	N/A
4	Installation of Innerduct in Conduit, 1.25-inch corrugated HDPE	FT	N/A
5a	Installation of Type 1 Handhole – HS-20, 24" x 36" x 36"	EA	N/A
5b	Installation of Type 2 Handhole – Tier 22, 24" x 36" x 36"	EA	N/A
5c	Installation of Type 3 Handhole – Tier 22, 11" x 18" x 18"	EA	N/A
5d	Installation of Type 4 Handhole - Tier 22, 16" x 22" x 18"	EA	N/A
6a	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, outdoor	FT	0
6b	U/G Fiber Optic Cable Placement, 12-strand, loose buffer tube, plenum-rated	FT	N/A
6c	U/G Fiber Optic Cable Placement, 24-strand, loose buffer tube, outdoor	FT	0
6d	U/G Fiber Optic Cable Placement, 48-strand, loose buffer tube, outdoor	FT	0
6e	U/G Fiber Optic Cable Placement, 144-strand, ribbon, outdoor	FT	0
6f	U/G Fiber Optic Cable Placement, 288-strand, ribbon, outdoor	FT	#VALUE!
7	Removal of Fiber Optic Cable from Conduit	FT	N/A
	Rock Bore Adder Unit (Hard Rock)	FT	#DIV/0!
	Rock Bore Adder Unit (Intermediate Rock)	FT	#DIV/0!
	Rock Removal Excavation Adder Unit	FT	N/A
	Install Additional 1.25" ID in Conduit	FT	N/A
	Aerial Fiber Optic Cable Placement, labor and installation hardware, not including make-ready or cable material price	FT	#DIV/0!
	Aerial Feeder Cable, outdoor 12-count, material only	FT	0
	Aerial Feeder Cable, outdoor 24-count, material only	FT	0
	Aerial Feeder Cable, outdoor 48-count, material only	FT	0
	Aerial Feeder Cable, outdoor 144-count, material only	FT	0
	Aerial Feeder Cable, outdoor 288-count, material only		#VALUE!
	Utility pole make-ready cost	FT	#DIV/0!
	Fiber Tap Assembly, 4 - 12 ports, plus stub cable (based on average port/stub cable pricing)	EA	N/A


### Conduit/Fiber OSP Construction

#### Distrubtion Splicing

8	Installation of Straight-Through Splice Enclosure, 288-strand capacity, mass-fusion splice	EA	N/A
9a	Installation of Mid-sheath Splice Enclosure (Ring Cut), 72-strand capacity, single splice	EA	N/A
9b	Installation of Mid-sheath Splice Enclosure (Ring Cut), 144-strand capacity, single splice	EA	N/A
10	Fiber Splicing, Individual Strand (per strand)	EA	0
11	Mass Fusion Splices (per ribbon)	EA	N/A

#### Splicing

#### Distribution Termination and Testing

12	OTDR Testing of Un-terminated Backbone Cable (per strand)	EA	N/A
13	OTDR Testing of Un-terminated Lateral Cable (per strand)	EA	N/A
14	Final Acceptance testing of Terminated cable (per strand)	EA	N/A
15	Installation of Backbone Termination Panel, 288-strands	EA	0

#### Termination and Testing

#### Lateral and Service Drops

10	Fiber Splicing, Individual Strand (per strand)	EA	N/A
11	Mass Fusion Splices (per ribbon)	EA	0
20a	Lateral Termination Panel, rack-mount, 12-strands	EA	N/A
20b	Lateral Termination Panel, wall-mount, 12-strands	EA	0
20c	Lateral Termination Panel, rack-mount, 24-strands	EA	N/A
2c-1.25	Installation of Conduit in Unpaved Right-of-Way - Trench, 1.25-inch SDR 11	FT	0
16	Installation of Innerduct, 1.25-inch corrugated HDPE, plenum-rated	EA	0
	Installation of Direct buried drop cable - Trench/Plow	FT	N/A
21a	Installation of Individual FTTP Service Drop Cable, SC-APC, 250 foot	EA	0
21b	Installation of Individual FTTP Service Drop Cable, SC-APC, 500 foot	EA	0

#### Lateral and Service Drop

<b>Unit Price</b>	<b>Budget Total</b>
\$ 55.00	\$ -
\$ 9.50	N/A
\$ 10.00	N/A
\$ 13.00	N/A
\$ 34.29	N/A
\$ 24.74	\$ -
\$ 37.40	N/A
\$ 20.00	N/A
\$ 20.00	N/A
\$ 22.00	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1.75	N/A
\$ 1.50	N/A
\$ 1,425.00	N/A
\$ 1,050.00	N/A
\$ 450.00	N/A
\$ 525.00	N/A
\$ 0.90	\$ -
\$ 1.30	N/A
\$ 1.23	\$ -
\$ 1.40	\$ -
\$ 2.00	\$ -
\$ 2.50	N/A
\$ 0.33	N/A
\$ 50.00	N/A
\$ 30.00	N/A
\$ 23.50	N/A
\$ 0.52	N/A
	\$ -
\$ 5.37	N/A
\$ 0.25	\$ -
\$ 0.58	\$ -
\$ 0.75	\$ -
\$ 1.75	\$ -
\$ 2.05	N/A
\$ -	N/A
	\$ -
#VALUE!	N/A

	\$	-
	\$	-

**Action Subtotal:** \$ -

\$ 1,210.00	N/F52A
\$ 850.00	N/A
\$ 970.00	N/A
\$ 14.23	\$ -
\$ 42.39	N/A

**Excavating Subtotal:** \$ -

\$ 14.26	N/A
\$ 19.75	N/A
\$ 26.18	N/A
\$ 10,750.00	\$ -

**Stringing Subtotal:** \$ -

\$ 14.23	N/A
\$ 42.39	\$ -
\$ 926.85	N/A
\$ 974.75	\$ -
\$ 1,384.83	N/A
\$ 9.64	\$ -
\$ 5.60	\$ -
\$ 6.00	N/A
\$ 384.99	\$ -
\$ 547.97	\$ -

**Cable drops Subtotal:** \$ -

Excavation labor only - no cable material.

Cable material and labor for drop placement in conduit or aerial attachment

Cable material and labor for drop placement in conduit or aerial attachment

**Total:** \$ -



- excavation seperate.
- excavation seperate.

## Tap Assembly Cost Worksheet

### ***Tap Housing contract rates***

Ports

Stub	4	6	8	12	<b><i>Housing/Assembly cost per port above 4</i></b>		
100	299	397	435		49	19	
200	377	418	429	512	20.5	5.5	20.75
300	396	440	545	594	22	52.5	12.25
400	475	521	581	659	23	30	19.5
500	549	540	586			23	
600	1047	915	870	912			10.5
700		1122	1173			25.5	
800	1091			1084			

### ***Cost per additional foot above 100 ft.***

Avg: \$ 23.79 per port

0.78	0.21	-0.06	
0.19	0.22	1.16	0.82
0.79	0.81	0.36	0.65
0.74	0.19	0.05	
	3.75	2.84	
	2.07		

Avg: \$ 0.84 per foot

Site Classification

Core / Backbone

Lateral

N/A

Suburban

Urban