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Appendix A – Common Community Objectives

Prepared for the City of Madison

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1 Introduction

No matter how demographically and geographically different they are, most localities that seek to deploy fiber-to-the-premises (FTTP) networks share certain objectives. Sometimes the primary objectives align, but they also may directly conflict with one another. It is important for the City to consider at the outset its primary, nonnegotiable goals—and to expand to other objectives from that starting point.

This analysis seeks to help the City understand the interplay between common objectives so that it can make decisions about which of its goals are most important, and how to achieve access to broadband in a way that makes sense in Madison.

The City has enacted equity initiatives to address inequality based on class, race, and other factors that may make certain populations vulnerable. The City's equity goals inform our overall analysis. The most important way the City can ensure that its broadband initiative is consistent with its equity goals is to strive to bring the network to every location in Madison (see Section 3.1), known as a ubiquitous build-out. This analysis assumes that ubiquity is a baseline goal for the City, consistent with its equity initiatives and its desire to ensure that all members of the community have equal access.

Additionally, instead of considering open access separately, this analysis looks at the objectives that drive the desire for it, and how the City might attain those goals. As OTT programming and applications become increasingly prevalent, the need for traditional open access is waning. The City may find that it can achieve its open access goals, thus promoting competition and consumer choice, through alternative means. If the City builds a ubiquitous network, and then partners with a private entity to manage operations and provide an unfettered data service, this introduces a new competitor into the market and drives competition at the applications layer.

2 The Relationship Between Common Broadband Objectives

Many communities share common objectives when considering an investment in a broadband network. In our experience, most localities have some or all of the following goals:

- Ubiquity
- Affordability
- Consumer choice
- Competition in the market
- Ownership and control of assets
- Performance
- Risk aversion
- Positive cash flow

Choosing which goals to prioritize can be challenging; we sought to provide the City with information to empower decisions about its connectivity needs that will have ongoing positive outcomes. We used as the basis for our analysis the assumption that the City wants to pursue a universal, or ubiquitous, build-out. It is our understanding that the City wants to bring a fiber connection to every home and business in the City of Madison, and that the City is resolute about serving traditionally underserved residents.

It is important for the City to understand how these objectives interact with each other, how pursuing one objective may mean foregoing another, and how prioritizing objectives can impact the City's decision-making process as it moves forward. Each community must balance its needs so that it can achieve its goals without sacrificing objectives it deems essential. It is important to understand what is behind each of these objectives, and why the City may be compelled to pursue one over another.

As an example, risk aversion is top priority for some communities; it may be politically challenging to build a network, and the only way to complete it is to assure key stakeholders and the public that there is minimal risk involved. As we explain below, however, risk aversion directly conflicts with the goal of building the network throughout an entire community.

We illustrate in Table 1 below the intersection of common objectives. As the key at the top of the table shows, one objective may have no impact on another (NI), objectives may align (A), or they may conflict (C).

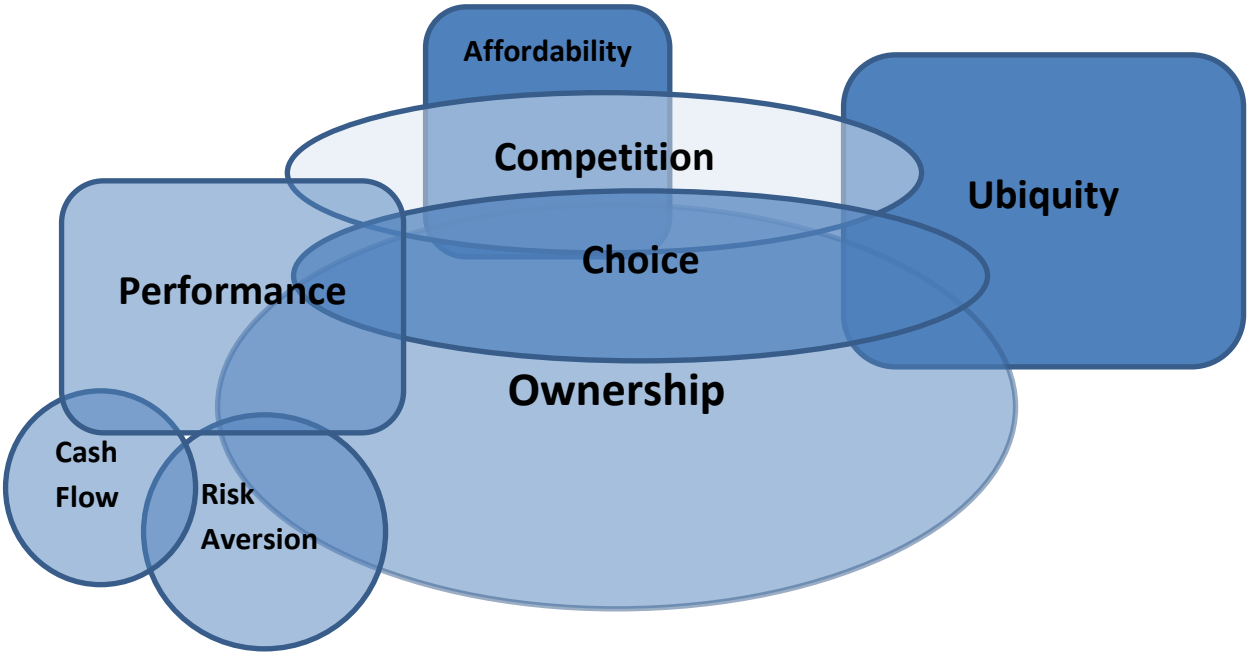
Table 1: Common Goal Alignment

A: Align **C:** Conflict **NI:** No Impact

	Ubiquity	Choice	Competition	Ownership	Performance	Affordability	Risk Aversion	Cash Flow
Ubiquity		A	A	A	NI	C	C	C
Choice	A		A	A	A	A	C	NI
Competition	A	A		A	A	A	C	NI
Ownership	A	A	A		A	A	A	C
Performance	NI	A	A	A		NI	A	A
Affordability	C	A	A	A	NI		C	C
Risk Aversion	C	C	C	A	A	C		A
Cash Flow	C	NI	NI	C	A	C	A	

In the sections below, we further define these objectives, explain this table, and outline how the objectives listed here interact and overlap with one another. We also describe how prioritizing one objective may impact the City's ability to focus on another. Figure 1 below shows a visualization of Table 1 to illustrate the relationship between common objectives.

Figure 1: Interplay between Objectives



There are numerous possible outcomes associated with different objectives, and the City has to determine what it believes will best serve its unique needs, and have the greatest impact on the community. This analysis does not seek to urge the City in any particular direction, but takes into consideration the City's articulated goals, and attempts to clarify and flesh out what may drive a desire to achieve certain objectives.

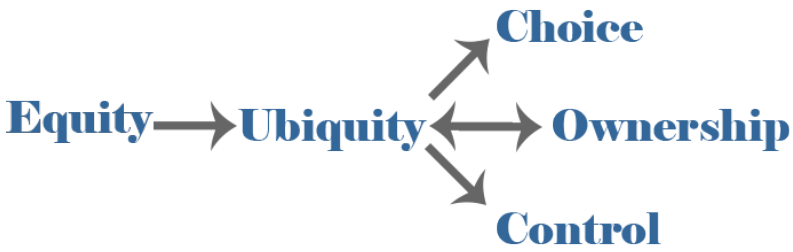
As we noted, some objectives may interact favorably with others, overlap, or have no impact. For example, performance either interacts favorably or not at all with other objectives, and prioritizing performance can have a significant positive impact on the FTTP network's viability by setting it apart from incumbent providers. There are no real disadvantages to making performance a top priority for the FTTP network because doing so does not require the exclusion of any other objectives. The City has already demonstrated a commitment to performance through its meticulous documentation and successful operation of its existing network. We encourage a continued commitment to performance and pursuing other objectives in parallel.

3 Detailed Descriptions of Common Objectives

3.1 Ubiquity – Service Is Brought to All Areas of a Community

For most communities that opt to build and operate a network, ubiquity—which refers to designing and building the network so that it connects every residence, business, and institution in the community—is a key objective. Incumbent providers have traditionally often built only to the most affluent areas of a community where they are sure to see a return on investment (ROI), a practice known as "cherry picking." Many communities are compelled to build a ubiquitous network to safeguard against leaving behind those parts of a community that may not be desirable to private providers. Communities throughout the nation have prioritized ubiquity as a primary goal in their broadband pursuits,[1] and our analysis assumes this as a baseline objective for the City. As we noted, this is consistent with the City's equity initiatives because building the network to every location in Madison increases the potential for access, even for the City's most vulnerable populations. As illustrated in Figure 2, ubiquity aligns with choice, competition, and ownership.

Figure 2: Ubiquity Aligns with Choice, Competition, and Ownership



Ubiquity is a reasonable objective for any community; it makes sense that leaders want to bring service to the entire community, and we recognize the City's commitment to building a ubiquitous network. However, it is important to note that immediate communitywide build-out often entails significant risk and cost. The financial risk alone is considerable, and in order to make the model sustainable, many communities may have to price the service out of some consumers' reach. This is especially true in a traditional retail model, where the locality is the owns and operates the network, and provides service.

If the City opts to pursue an FTTP build-out where it retains ownership of the fiber optic network, it will have to seek large municipal bonds to cover the capital costs of building the network. It will then be responsible for making principal and interest (P&I) payments, known as debt service. If the City pursues a dark FTTP partnership model (see Appendix G), it may be able to work with its

[1] See, for example: http://www.cnet.com/news/connecticut-communities-join-together-for-gigabit-broadband/, http://broadband.blandinfoundation.org/_uls/resources/Vision_Statement_FINAL_0228.pdf, and https://www.portlandoregon.gov/revenue/article/394185.

partner(s) to implement a sliding scale fee structure for its most vulnerable populations. In such a model, the partner(s) might pay a lease payment to the City for use of City-owned fiber, plus potentially offer backstops for debt services obligations the City will incur. Further, the City's partner(s) may be willing to help the City cover its bond payments through a customer "lit" fees mechanism, or a per-subscriber fee.

If the City seeks to use revenues from the FTTP network and any retail service offered over it to cover its debt service payments, service fees will have to be calculated with the total cost of P&I in mind. Unless the City is able to implement a sliding scale fee structure for its most vulnerable populations, those prices may not be affordable to all residents; thus, service prices based on the City's need to pay for a ubiquitous build-out will likely conflict with the City's goal of ensuring that service is truly *accessible* to all its citizens.

A full-scale build-out is typically not compatible with avoiding risk, as localities that seek ubiquity are likely to face stringent deadlines and much higher capital costs than a phased build-out. We note that even a phased build-out in a City the size of Madison will be expensive.[2]

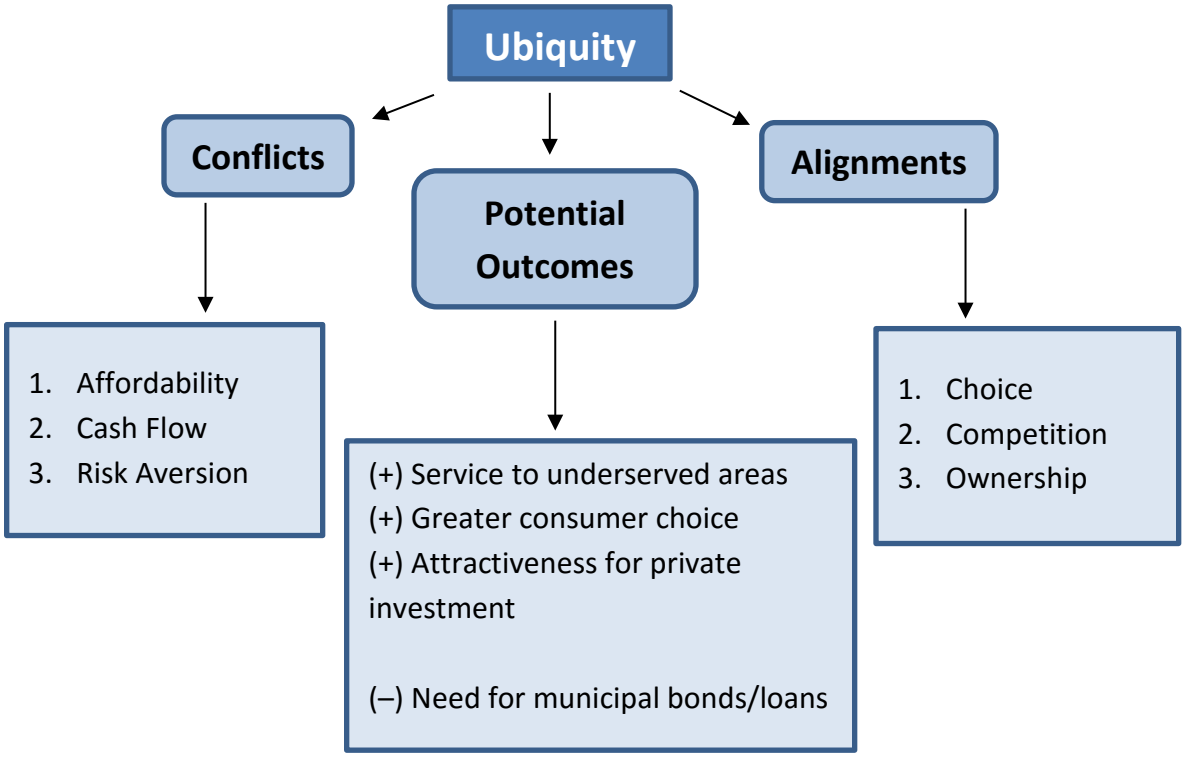
Maintaining positive cash flow is another objective that conflicts with ubiquity. While the City likely does not expect to make a profit on the FTTP network, it is important for the network to be financially sustainable, covering at least any debt service payments and operating costs. This is often referred to as "positive cash flow" or "breakeven." Assuming the City is responsible for the cost of deploying the fiber network, the higher cost to build to every structure in the City means that the point at which the FTTP network is able to establish positive cash flow will come much later than if the City slowly built out and began generating subscriber revenue earlier in the build-out process. While a partnership may enable the City to reach positive cash flow sooner than a fully-municipal deployment, ubiquity generally conflicts with positive cash flow.

The City may determine that the advantages of pursuing a ubiquitous network build-out will outweigh any of the potential conflicts with other common objectives. Further, as we noted, the City can take steps to manage some of the potential challenges associated with conflicting objectives (e.g., developing programs to help cover subscriber fees to ensure the service is not priced out of some consumers' reach).

The conflicts, alignments, and potential outcomes associated with prioritizing ubiquity are summarized in Figure 3.

[2] See *Appendix C – FTTP Cost Estimate* and *Appendix D – Financial Analysis for projected costs in Madison.*

Figure 3: Ubiquity Alignments, Conflicts, and Potential Outcomes



3.2 Affordability – Service Can Be Purchased by Citizens at All Income Levels

The City is acutely aware of its citizens' need for affordable service, as evidenced by its digital divide pilot initiative. As we noted, affordability typically goes hand-in-hand with accessibility. Affordability is of particular interest to Madison, where demand is likely low enough in some areas that private providers would not build there. As we noted, private providers typically "cherry pick" based on where they determine they are most likely to recover their cost to build—thus, they often build only in middle-to-upper-class neighborhoods.

Providing affordable service to the entire community would likely create benefits for the City in terms of enhanced quality of life and economic benefits. Further, the City could work with local government and nonprofit agencies to fully leverage benefits that are not monetarily quantifiable. These "benefits beyond the balance sheet" cannot be measured on a financial statement, but their impact communitywide is often profound.

The City may be able to balance ubiquity and affordability by negotiating an agreement with one or more private partners that includes sensitivity to the need for affordable, accessible services in all parts of the community. Similarly, the City may decide to subsidize services for certain portions of the community—potentially extending the pricing of the digital divide pilot beyond the original geographic and time parameters of that project.

Choice, competition, and ownership all interact favorably with affordability. If the City is able to reduce pricing to a level that is attainable to all of its residents, the expansion of consumer choice and the likelihood of increased competition will be notable. And if the City retains ownership of its broadband assets, it can make decisions about affordability similar to the control it can exert over performance.

If the City decides to subsidize services, it may find that prioritizing risk aversion and attaining positive cash flow become more difficult. The more debt and responsibility the City takes on, the higher its risk and the longer it will take for the FTTP network to be cash-flow positive. Similarly, even if the City does not directly subsidize services, prioritizing affordability may mean pricing the product low enough that it is challenging to also prioritize risk aversion and cash flow. It will be important for the City to determine its priorities, and to strike a balance so that one objective is not achieved at the exclusion of another.

3.3 Consumer Choice – Citizens Can Purchase Service from Various Providers

Localities often pursue open access as a means to increase consumer choice; this is an important consideration and a high priority for many communities. Incumbent cable and Internet providers may have little economic incentive to expand to areas of the community where they believe they will not recover significant portions of their cost.

A ubiquitous network that fosters open access, boosts competition, and reaches all parts of the community enhances consumer choice on a number of levels. In addition to gaining access to residential services that may previously have been unavailable, consumers often end up with greater flexibility to access services at various community locations. Ubiquity and competition enable enhanced services at community centers, religious institutions, educational facilities, and other locations that benefit residents.

Affordability of services ties directly with competition and consumer choice—being able to pay for services is often a major barrier for consumers. Having affordable access to services with competitive speeds can significantly improve quality of life, make residential areas more desirable, and spur business growth. Access to premium residential services at affordable prices can also incite home-based businesses, support continued education, and enable access to basic human services like healthcare and education.

Risk aversion could negatively impact consumer choice. If the City decides that it will slowly and organically build out its network and does not take steps to prioritize particularly vulnerable areas, it is possible that only the consumers who have traditionally enjoyed provider choice will be positively affected. The City may find that it can balance risk mitigation with community

benefit by deliberately funding service to portions of the community that may be undesirable for a private entity. If the City chooses to seek a partnership, this could be negotiated.[3]

3.4 Competition in the Market – Enabling Multiple Providers to Compete

Fostering competition in the market is generally the second component of an open access pursuit. That is, communities often seek to develop an open access infrastructure to enable multiple providers to offer service over the network and enhance competition. Like consumer choice, this is generally a major reason communities attempt to pursue a traditional open access infrastructure. Similar to consumer choice, competition in the market can be achieved through open access in the traditional sense as well as through other means.

The key for most objectives is to determine whether they are primary, how they may conflict with others, and how best to pursue whatever a community deems is its most important goal(s). We believe that competition both upholds and is upheld by other potential primary objectives—it aligns with, does not impact, or is not impacted by other common community objectives. The only potential exception to this is risk aversion, which we explain below.

Choice and competition go hand in hand, and seeking ways to encourage competition will likely only result in greater consumer choice in communities. Similarly, a ubiquitous network build will probably result in greater competition among local providers. This is not only through providers potentially offering services over the City's network, but also in the form of incumbent providers lowering prices and enhancing services in response to improved services by other providers.[4] This also speaks to competition vis-à-vis affordability and network performance: the greater the market competition, the greater the likelihood that other providers will seek to improve their services and lower their prices.

Competition in the market and consumer choice can be prioritized simultaneously with other objectives without negative consequences, and localities often find that focusing on the overall well-being of their communities and citizens has numerous advantages.

It is important to note, however, that there may be some risk involved with creating competition in the market. The service provider industry can be inhospitable, particularly when the perception is that a public entity is attempting to compete with private industry. A major challenge faced by networks built and operated by public institutions is opposition from existing, private-sector providers. There are a number of reasons for this, some of which are related to perception while others relate to the market itself. Criticisms could range from unauthorized use of general or

[3] The Urbana-Champaign Big Broadband (UC2B) public network negotiated a similar partnership with a private entity, which will be passed on in the event of any sale or transfer of the network.

[4] Marguerite Reardon, "Google's fiber effect: Fuel for a broadband explosion," *CNet*, April 30, 2014, http://www.cnet.com/news/googles-fiber-effect-fuel-for-a-broadband-explosion/, accessed April 2016.

other funds for debt service coverage, to questioning the need or demand for public-based connectivity services.

An important risk that the City should keep in mind is the potential for litigation from objectors ranging from incumbent providers to watchdog groups. Lafayette Utilities System (LUS) was sued by incumbent providers the same year it proposed creation of a separate utility for FTTP,[5] and the Tennessee Cable Telecommunications Association filed a lawsuit against Chattanooga's Electric Power Board (EPB).[6] These are only two examples of the litigation that public sector entrants to the market have faced from incumbent providers and others.

3.5 Ownership and Control of Assets

Retaining ownership of outside plant (OSP) assets is important to mitigate risk; owning assets is an important way for communities to retain some control of their networks. This includes a scenario in which a community pursues partnership with a private provider; a good way to balance risk and reward is for the City to maintain ownership and control of the fiber assets while it assigns operational responsibilities to a private partner. This enables both parties to perform functions that highlight their strengths while not having to expend resources and energy attempting to carry out tasks for which they are ill-equipped.

Cash flow could potentially conflict with ownership and control of assets, depending on the degree to which the City chooses to exert control. Maintaining a fiber optic network can be costly, particularly if the City opts to be the retail provider for the service. Operational expenses are a sizable and often unpredictable portion of overall network cost, and it can be difficult to get the take rate necessary to reach positive cash flow.

Other objectives either interact favorably or not at all with ownership and control of the assets. If the City retains complete control of the assets, it can make determinations about which provider(s), if any, can offer services over the network. It can regulate which service providers offer services and to what degree, thus allowing for considerable quality control.

The City may choose to oversee and maintain the network—a function with which it is already well accustomed and for which it is already staffed to some degree—and rely on a private partner to deliver retail services. The City may also be able to govern price points to support consumer affordability and service speeds to enhance performance. And because the City would own the network, it would be in control of performance.

[5] "About LUS Fiber: Timeline," LUS Fiber, http://lusfiber.com/index.php/about-lus-fiber/historical-timeline.
[6] "Cable Group Files Suit To Try To Block EPB Fiber Optic Plan," *The Chattanoogan*, Sept. 21, 2007, http://www.chattanoogan.com/2007/9/21/113785/Cable-Group-Files-Suit-To-Try-To-Block.aspx, accessed April 2016.

3.6 Performance – Standing Out with a Superior Network

Many communities are already served to some degree by incumbent providers—whether by large national cable or telephone companies, or small local ISPs. Network performance can thus be a powerful differentiator for a community broadband endeavor.

Prioritizing performance in a retail offering is not only advantageous, we believe it is necessary to make the City's offering stand out among existing broadband providers. Market entry is generally a major challenge for public sector retail providers, and even a public–private partnership will likely benefit from focusing on one or two highly specialized offerings to allow it to thrive among incumbents.

The City has already proven its ability to successfully operate a dark fiber network. While the City likely will not offer retail services directly, if it retains ownership and control of the dark fiber and partners with one or more private entities to provide service, it may want to build into its contract a high bar for performance standards.

The City may find that its FTTP endeavor will struggle and be more prone to failure if it attempts to compete with incumbent providers by offering services similar to existing packages. Instead, it is prudent to recognize gaps in the existing broadband market and seek to fill those with a unique service offering that incumbents are not currently able to provide. A 1 Gbps niche service may enable the City's and/or a private partner to enter the market and avoid competing with "me too" services.

A 1 Gbps service that is expandable to 10 Gbps and beyond may be the differentiator that the City needs to stand out. By focusing on an extremely powerful data-only offering and communicating with potential subscribers about the advantages of a high-performance, unfettered data product, the City may spark the shift in the market it needs to be successful. The goal is to focus on *unbundling* from the traditional triple-play (i.e., focusing on data, not on cable and phone service), and effectively encouraging consumers to leverage the data service to its fullest capacity.[7]

Performance interacts favorably or not at all with other objectives, which is shown in the visual breakdown in Figure 3. There are no disadvantages to prioritizing performance as a key objective in a community build, and we believe that this should be a main focus of any fiber enterprise.

If the City retains ownership of its assets, it also has better control over performance. By owning the network over which services are provided and overseeing a private entity that is serving end

[7] It may be challenging to attract users who are accustomed to triple play services, but it will be a far greater challenge to compete with incumbent providers by offering the same packages.

users, the City can require the level of performance that it deems appropriate to best serve the community's needs.

Risk aversion and cash flow both interact well with performance. We believe that the City minimizes its risk by entering the market with a 1 Gbps high-performance network. The City can set itself apart from other providers by offering a high-speed data product that incumbents cannot.[8] Further, it can differentiate itself by having an always-on, extremely reliable service that customers can use in new and beneficial ways—like to operate a home-based business, telecommute to their job, or pursue an advanced degree.

3.7 Risk Aversion – Minimizing the City's Exposure and Liability

There are numerous potential risks that the City may face as it considers FTTP deployment—financial, legal, and political, for example.[9] While it is necessary to avoid risk to some degree, it is equally important to balance risk and reward. It may take considerably longer to design, build, and deploy a network if risk aversion is the City's top objective. The "slow and steady" approach is not without merits, but it is also unlikely to give a community a competitive edge. Decreased speed to market—or building out slowly—gives competitors more time to respond to the City's approach.

Figure 4 shows a risk and reward matrix that highlights the City's most likely low-risk-low-reward, low-risk-high-reward, high-risk-high-reward, and high-risk-low-reward outcomes. The lowest risk with the highest potential reward lies in building the network in a phased approach, specifically based on the Google Fiber build-to-demand model.[10] In this approach, the company signs up subscribers by neighborhood (known as "fiberhoods" in the Google Fiber model); once a neighborhood has reached a certain threshold level of committed subscribers, fiber will be built there.

[8] It is important to note that products like AT&T's GigaPower and Comcast's Gigabit Pro do not set their advertised 1 Gbps and 2 Gbps service as a baseline, which is what we have suggested to the City. Rather, these products offer a 10 Mbps to 100 Mbps baseline with the potential to deliver 1 Gbps to 2 Gbps service as occasional exceptions. The City, on the other hand, may be able to provide service up to 10 Gbps and beyond with 1 Gbps as its baseline.
[9] CTC cannot provide legal advice or guidance; the City is working directly with its legal counsel.
[10] Alistair Barr, "Google Fiber Is Fast, but Is It Fair?", *The Wall Street Journal*, August 22, 2014, http://www.wsj.com/articles/google-fuels-internet-access-plus-debate-1408731700, accessed May 2016.

Figure 4: Risk and Reward Matrix

Reward \ Risk	High	Low
High	o Deploy a ubiquitous communitywide FTTP build, partner with a private provider to operate the retail component, City maintains ownership and control of assets	o Prioritize risk aversion to avoid bonding, slowly expand network in a phased approach and engage a private partner for operation and retail services
Low	o Compete with tiered services similar to incumbents – a "me-too" offering.	o Maintain current network and do not pursue expansion of services

It is important to note that this approach may necessarily sacrifice certain other objectives like affordability and consumer choice. Risk aversion will generally come at the expense of objectives like these, and it especially conflicts with a ubiquitous build-out.

However, these objectives do not have to be mutually exclusive; instead, the City has to decide to what degree it wants to prioritize which objective, and be prepared for possible conflicts and how to mitigate those. For example, if the City chooses a phased approach, it may opt to first expand service to a location that can demonstrate the power of the network. This will support marketing, and can potentially help convince consumers to sign up for service, thereby achieving ubiquity in a lower-risk fashion.

While the City's pilot project offers only 10 Mbps service and cannot demonstrate the power of a gigabit service offering, the infrastructure that the City and its pilot partner construct to support the pilot customers may help speed the process of continuing to expand the FTTP network. Further, the neighborhoods that the pilot project serves are not the most desirable areas for private providers; by building to these neighborhoods first, the City can make itself more attractive for partnership with a company that may otherwise struggle to serve areas where ROI is likely to be lowest.

The City also has an advantage in the existing Metropolitan United Fiber Network (MUFN) footprint, which may enable a faster build-out, even through a phased approach. Depending on the strand count and the MUFN fiber's usability as a backbone for a citywide FTTP deployment (see Appendix C – FTTP Cost Estimate), and the parameters of a potential partnership, the City may be able to use an accelerated phased approach to achieve a citywide build-out.

Risk aversion conflicts with ubiquity, choice, competition, and affordability. As we previously noted, it will be challenging to obtain a ubiquitous build-out at all, and especially not within a few years, if the City prioritizes risk aversion as its key objective. Because the network is unlikely to be built out quickly in this case, prioritizing risk aversion also reduces the likelihood of increased competition and choice. As we previously noted, the City's speed to market is critical to securing its potential competitive edge and taking full advantage of its unique niche service offering. Further, affordability becomes more difficult to achieve if risk aversion is prioritized because the City would then need to align service fees to support self-sustaining operations; this would mean that the monthly service fees would be priced higher to avoid requiring a City subsidy.

If the City chooses to prioritize risk aversion, it will align with ownership, cash flow, and performance. Ownership of the assets usually means lower risk for the City because it has greater control and flexibility.

3.8 Positive Cash Flow – Becoming Financially Sustainable

Becoming cash flow positive is an important goal for any business or entity, and it is also a bit complex to define. Net income is often referred to as "cash flow," though this is technically incorrect because depreciation is a non-cash expense.

Earnings before interest, taxes, depreciation, and amortization (EBITDA) is the difference between operating revenues and operating expenses; it is a key metric in designing a viable financial model, along with net income. In a capital-intensive business such as an FTTP enterprise, EBIDTA must quickly become positive to keep the enterprise afloat. When EBITDA becomes positive, the business can be said to be cash flow positive. Net income then deducts interest, taxes, and depreciation. Revenues are tied to an enterprise's ability to be sustainable or cash flow positive. Collecting revenues to pay off debt and support business operations bolsters the net income and increases the likelihood that it will become positive.

Several objectives may conflict with cash flow, like affordability, ownership, and ubiquity. As we noted, revenue collection directly impacts cash flow so higher revenues mean a greater likelihood of being cash flow positive. If the service is priced affordably, this may mean lower monthly service fees and a longer path to the enterprise becoming cash flow positive, or self-sustaining.

Ownership may also impact cash flow, especially if the City elects to retain ownership of all network electronics, including customer premises equipment (CPEs). Depreciation costs are significant, and it is important to reserve funds for equipment and infrastructure replacement. Typically, last-mile fiber and CPEs are replaced after approximately five years, core network equipment is replaced after seven years, and outside fiber and facilities are replaced after 20 to 30 years. Because the useful life of fiber is considered to be 20 years or more, our financial analyses do not account for its replacement. If the City opts to build and own only the dark fiber portion of the network, its risk will be much lower than if it is responsible for core network equipment and CPE replenishments.

Another element of ownership in the context of cash flow is the need for network maintenance and locating costs. Although the City has experience with maintaining a fiber optic network, increased costs associated with serving an increased volume of end users may be significant in terms of both locating and replacing equipment at customer homes and businesses.