Broadband Business Plan for York County, PA

January 2021

Lit Communities

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Executive Summary

In August of 2020 York County (“York”, “County”) invited proposals from a small group of qualified firms located near York or with ties to the community. Lit Communities (“Lit”) and Katapult Engineering (“Katapult”) responded to the invitation and were contracted by York to conduct a Countywide Broadband Community Assessment and a Pilot Project. This Business Plan is a primary component based on the results of the Broadband Community Assessment which included the following tasks:

- Kickoff Meeting and Data Collection
- Preliminary Design
- Virtual and Field Construction Ride Out / Make Ready Engineering Assessment (CRO/MREA)
- Financial Model
- Grant Services
- Pilot Project along Heritage Rail Trail

The Countywide Broadband Community Assessment included the feasibility and financial modeling of a Middle Mile Network, Last Mile Network for 50k demand points and an extrapolated Last Mile, Fiber-to-the-Premise Network that includes the entire county. Lit and Katapult have completed the Kickoff Meeting, Data Collection, Preliminary Design and created Financial Models for the entire service area.

In parallel to the Community Assessment, the Rail Trail CARES Act project is being completed which will cover 16 miles of new fiber infrastructure. The project begins in the City of York and will go down to New Freedom. Lit and Katapult helped the County prepare RFPs and select vendors to provide materials and complete the construction. The fiber placed down the Rail Trail will play a much larger role in York's overall planned network and has been incorporated into the preliminary design as part of a larger middle mile network.

The data and recommendations in this document are a direct product of these tasks and the Community Assessment process. The results of the data analyzed to date shows strong evidence of the need for a County-wide fiber middle mile infrastructure network that will support the much needed fiber-to-the-home and business network. This network will improve the lives of residents and bring them up to date in this new connected world. The most recent COVID-19 pandemic has underscored the needs for proper connectivity from the homework gap, to the telehealth and telework gaps as well. The partners on this project are

dedicated to addressing current needs and also better preparing York County residents and businesses for the future.

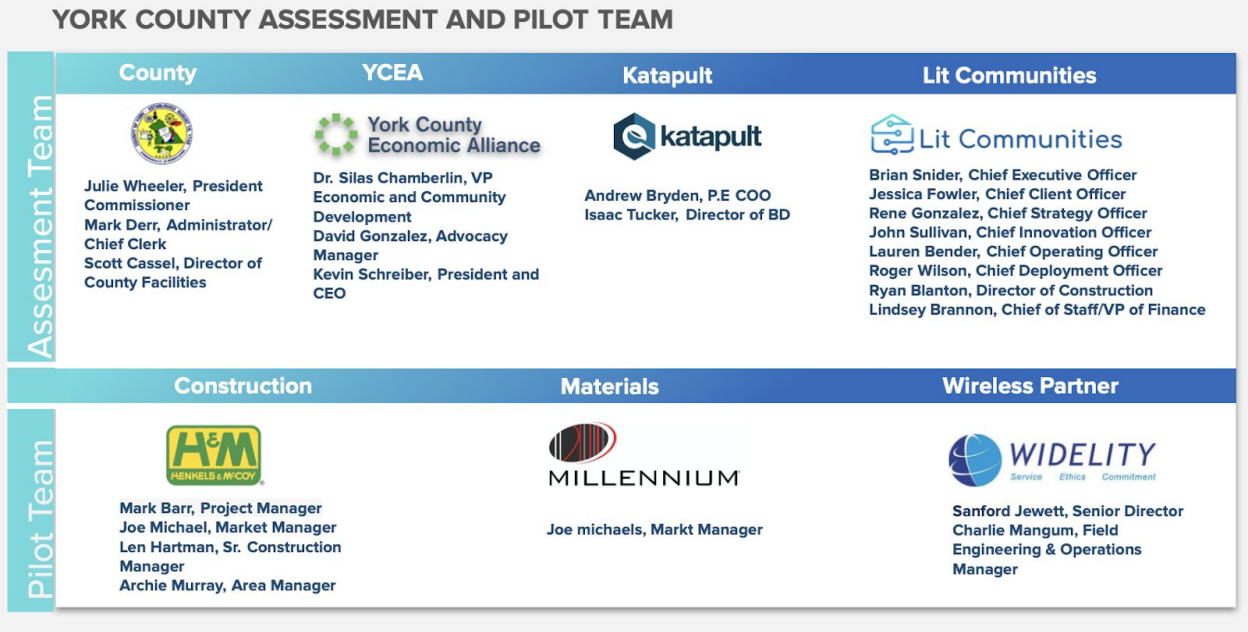
York County leadership is now in a good position to consider the next steps towards detailed engineering and construction of their network as presented in this Business Plan. Laying the foundation of the network by first pursuing the construction of Middle Mile infrastructure rings that will ensure Last Mile customers have uninterrupted high speed internet services. The Middle Mile will also provide a solid "highway" to run future smart technologies that will bring efficiencies to the community. Moving to detailed engineering and network customer demand aggregation along with "sign-up" phases can strengthen the financial model and provide greater transparency and greater certainty around take rates and project costs. York is now well positioned for the next phase of this project and to work with Lit and Katapult to determine the desired ownership and potential business models for the network. A capital stack using grants, and private and public funding can then be finalized.

Summary breakdown of Middle Mile

Expense Type	Cost
One time Expenses	
Engineering	$1,774,859
Construction	$38,955,802
O&M During Construction	$1,056,767
ISP Costs Operation & Construction	$1,099,545
Subtotal	$42,886,973
Recurring Expenses	
O&M (annual)	$109,140
ISP (annual)	$235,200
Subtotal	**$344,340**
Annual Revenue (in 2022)	
FTTH Partner	$911,345
Services	$96,231

Dark Fiber Leases	$1,094,620
Subtotal	**$2,102,196**

Stakeholders / Team



Stakeholder & Team Profiles

York County, PA	
About:	York County is home to more than 440,000 people, York offers big-city amenities with small-town charm. Whether you're after a chic urban loft or a countryside retreat, York County has it all. While continuing to embrace its agricultural roots, York also has evolved into a manufacturing and business hub. Major companies with roots here include Harley-Davidson, York Barbell, Voith Hydro, York International, Utz Quality Foods, Snyder's of Hanover, BAE Systems and more. You'll find great schools, a low cost of living, quality health care and boundless entertainment opportunities. There's a park in nearly every corner of

	the county, a strong performing arts community, sports and lots of shopping opportunities. Plus, York is only a short drive away from Philadelphia, Harrisburg, Pittsburgh, Baltimore, Washington, D.C. and New York City.
Role:	Client
Key Aspects:	The County is looking to support initiatives that close the digital divide, especially in light of the COVID-19 pandemic with more business and education being conducted from home. The County is also looking to foster economic development.

About:	The York County Economic Alliance is a 501(c)6 organization founded in 2012 through an affiliation between York County's chamber and economic development organizations. The YCEA is the county's primary business resource for facilitating expansion, funding, redevelopment, networking, business-to-business promotion, advocacy and workforce development among many other services.
Role:	Lead Partner
Key Aspects:	YCEA is interested in fostering economic development in current and future industrial and manufacturing centers, providing opportunities for workforce development and training.

About:	Lit Communities is both a forward-thinking builder and operator of next-generation network infrastructure and a consultancy that guides communities across the country through the complicated process of deploying their own open application fiber optic utilities.

	Lit Communities believes that by separating the network infrastructure from the services provided on it, a more resilient and consumer-friendly environment is created. This approach makes otherwise prohibitively expensive networks feasible to build in communities of all sizes.
Role:	Consultant
Key Aspects:	Lit led the County's Community assessment effort and managed all aspects of the Pilot Project along the Heritage Rail Trail, Created financial models and scenarios and assembled this business plan.

About:	Katapult Engineering has been a leading OSP engineering, software development, and consulting firm since 1991. Their work ranges from being the boots on the ground for local utilities and fiber companies to developing software solutions to make collecting and processing this information easier than ever before.
Role:	Consultant / Boots-on-the-ground
Key Aspects:	Katapult Engineering is local to Dillsburg PA and coordinated on-site with construction crews, site walks, locates and meetings for the Pilot Project. They also conducted Construction Ride Out and Make Ready Engineering services to support the Community Assessment.

About:	Founded in 1923, Henkels & McCoy, Inc., is a privately held infrastructure construction, design, and engineering contractor with a rich history of connecting the world's strongest utility infrastructure networks. Using their proven Connected Infrastructure Model™, they connect all fundamental parts and processes of successful infrastructure construction. From installing the nation's first Community Access Television (CATV) system to constructing the Keystone Pipeline to restoring power after some of the country's

	worst natural disasters and everything in between. Their people have the experience and the technical skills to complete any project within the power, oil & gas pipeline, gas distribution, and communications markets.
Role:	Construction Partner
Key Aspects:	Henkels & McCoy responded to and was awarded the Construction bid for the pilot project RFP along the Heritage Rail Trail.

About:	Millennium is more than a materials supplier. They are redefining what a distributor means. As a national distributor of fiber optic materials that build broadband networks, Millennium offers a host of solutions to help providers – everything from introducing new technologies that make networks more reliable, to managing project and material needs, to the rental and leasing of capital equipment.
Role:	Materials Partner
Key Aspects:	Millennium responded to and was awarded the materials bid for the pilot project RFP along the Heritage Rail Trail. They delivered materials in conjunction with the construction schedule.

About:	Widelity is a leading provider of business and network engineering consulting services for Telecom Service Operators and the technology infrastructure and application development community
Role:	Wireless Consultant worked on wireless engineering, mobile tower acquisition and provided wireless best practices incorporated into this report.
Key Aspects:	Widelity is acting as wireless technical expert and wireless designer on the project.

Community Assessment Process and Timeline

Below is a recap of tasks completed to date, findings as well as ongoing and future tasks that were contracted by York County as a part of the Countywide Broadband Community Assessment.

Task # 1– Kickoff Meeting and Data Collection

Completed October 2020

As a first step after contract execution, Lit, Katapult and York County met for a virtual kickoff meeting and:

1. established the overall project goals,
2. created a shared point of contact list,
3. defined the service area boundaries,
4. went over an overview and schedule for each task,
5. defined all data needs and set delivery expectations

The project team then created a base map of the York County service area based on GIS and address data sent by the County. The project team evaluated county data and provided feedback. Using the provided data and based on initial conversations County partners were

then identified and a database was created including a data dictionary to be used in later tasks including data aggregation and preliminary design.

Task #2 - Preliminary Design Set Up and Execution

Completed October-November 2020

Preliminary Design was produced using automated design software based on data provided by the York County Planning Commission. This automated design software combined quantitative analysis with machine learning to generate designs that were optimized for cost efficient network deployment. During this task, we created preliminary designs for the County's backbone and potential FTTP networks. This process reduced planning and design time and will also translate into subsequent material and labor cost savings when constructing the network.

The objective of the Preliminary Design was to enable data driven analysis of the costs and major impacts during the deployment of the network including:

- value engineering,
- selecting active electronic equipment and sites,
- the amount of fiber, materials, and electronics needed,
- ratio of underground and aerial network placement,
- long lead permit avoidance,
- minimization of necessary traffic control,
- constructability in congested areas,
- ease of maintenance and future access,
- minimization of utility strikes

Task #3 – CRO and Make Ready Engineering Assessment and Pole Digitization

Completed November 2020

The project team completed a virtual Construction Ride Out ("CRO") to thoroughly analyze the outside plant infrastructure placement for cost and schedule efficiency. Using the path from the initial Preliminary Design:

- Areas were identified as primary build out phases.

- The Preliminary Design path was evaluated by desktop with notes created using field software on a laptop.
- Path was updated live for changes to properly identify aerial vs. underground and the methodology including trench, plow, bore as well as identify street cuts, etc.
- Lit then updated the initial preliminary design and created an updated bill of material estimates based on the CRO.

During the virtual CRO Lit also completed the following Make Ready Engineering Assessment tasks:

- Performed a high-level visual check of poles for usability, and
- Classified poles into a category to best determine total make ready costs.

Construction Ride Out Findings (CRO)

Katapult Engineering led an aerial assessment and Construction Ride Out where they documented the 107,006 poles in York County. (see below screenshot) A random sampling was done on the documented poles to estimate Typical Make Ready costs per mile per typical build environment. (see attached table) On average a rural pole costs approximately 58% less in make ready costs than a pole in urban areas. Some make ready will be necessary when going aerial due to attachments by other utilities. Some of these will be remedied by pole changes but the vast majority will require that the incumbent company moves their infrastructure to a lower attachment on the pole. For the pole change/replacements the most economic solution will often be to go underground, however in certain cases the poles requiring replacement are in the middle of an otherwise good and usable pole line, and in these instances we advise replacement.

Area Type	Average Cost Per Mile	Sample Sets
Industrial	$38,967	3
Urban	$35,850	7
Suburban	$20,491	11
Residential	$18,988	8
Rural	$14,858	21
Grand Total	**$21,144**	**50**

Screenshot of digitized poles in York County from Construction Ride Out

Task #4 – Financial Model and Business Plan

Completed November-December 2020

Lit and Katapult's management teams created a detailed financial model to provide York County and other vested parties the necessary information to make an educated decision to complete the network build out. Financial models for both a Middle Mile and a Last Mile Network were created and incorporated into this Business Plan.

Identified Deployment Approach

With the evolution of fiber optic networks, there are several technical and financial options available to evaluate. Recognizing that many community leaders do not have specialized knowledge or experience related to fiber optic network planning, design, and management, Information was gathered to provide guidance to York County regarding options for the network, including:

- Ownership

- Architecture and serviceable scope
- Operations and management
- Marketing and build out sequencing
- Pricing strategies
- Funding

The project team consulted with our partners to provide the capabilities of different revenue sources across a solid infrastructure foundation. With our collaborative approach and strategic planning, the network will be “best in class” to accommodate unforeseen needs over the lifetime of the system. The project team also used data obtained to develop requirements for the network to support various “smart city” applications.

Detailed Financial Model and Business Plan

Based on all the information and work completed during the aforementioned tasks, a comprehensive business plan was completed with detailed financial modeling for both a Middle Mile and Last Mile Network.

Task #5 - Strategy Session

Completed December 2020

After the delivery and review of this Business Plan and Detailed Financial Model Lit will conduct a Strategy Session with York County with all primary stakeholders to discuss best practices in municipal broadband network planning, design, construction, funding and a deployment schedule to complete connectivity. Lit will give an overview of the results of all tasks and outline the business plan and financial model while answering questions York might have. Lit will discuss its recommendations for next steps to keep the project moving forward including:

- Local marketing campaigns
- Grant research and identification of eligible programs
- Capital introductions
- Detailed design and construction package creation
- Permit and pole attachment agreements
- Construction management and inspection
- Operations and maintenance

Task #6 - Grant Development Services

Completed December 2020

Lit's grant services team has conducted research and will present Broadband Grant Development Services for York County. Details on these services can be found in the grants portion of the recommendations section in this document.

Grant services included the following:

- Broadband Grant Development Strategy Session
- Federal and State research on existing and new (CARES Act and upcoming) broadband grant programs for the Client capable of expanding the County's network funding needs,
- Development and evaluation of prospective project opportunities identified in the Business Plan:
    - identification of existing needs (grant specific),
    - identification of eligible project activities,
    - development of preliminary project description, scope of work, cost estimate and schedule,
    - coordination with the Client to review projects identified and determine whether to proceed with preparing a financial assistance application, and
    - prepare a prioritized list of project opportunities identified through this Task for pursuit of federal grant funding.

Project Goals

During the initial kickoff meeting and subsequent conversations between Lit, Katapult and the County regarding desired outcomes, additional project goals were developed. Listed below are these goals which this business plan directly addresses:

1. Stimulate economic development along "Main Streets"
2. Enhance connectivity to industrial and manufacturing hubs
3. Bring better connectivity countywide
4. Better connectivity for emergency services
5. Understanding financial models and capital stack

Incumbent Networks

York County has two major providers of Middle Mile service, Shentel and Zito. Both providers were contacted during the Community assessment and in relation to the Rail Trail Project in regards to lighting up temporary wireless services. The majority of Zito's network is in Northern Pennsylvania and extends down into York County. The majority of Shentel's network is located in Virginia and extends up into Pennsylvania into York County. Shentel's network is well positioned right next to the Rail Trail path and Zito's network was not much

further away. These incumbents should be considered when moving forward with building out the remaining Middle Mile network or any Last Mile partnerships.

Network Design/Architecture

Utilizing our proprietary automated design tools, a preliminary Middle Mile and Fiber-to-the-Premise network was completed for York County. Data shared by York including GIS data, as well as anchor institutions, were used in the development of a preliminary path design. This data is fed into the automated design tool to build out the path taking into consideration both actual infrastructure and the priorities of York County.

After the initial preliminary design was completed for both the Middle Mile and Last Mile Networks, Katapult and Lit's outside plant engineering experts virtually drove as well as visited questionable sites along the selected path to inspect the pole lines and ground conditions. Poles were inspected and rated based on pole congestion that may require make-ready work to allow for the proper space to attach new fiber as well as the need for pole replacements based on condition. A synopsis is included above under the Construction Ride Out and Make Ready Engineering section. Ground conditions were assessed to take note of any major obstructions or other problematic conditions that may exist along the designated path.

All of the in-depth condition assessment and rating completed during the Construction Ride Out and Make Ready Engineering Assessment were taken and reworked into the final design and financial model. Both design decisions and cost models were updated to reflect the best and most feasible design and financial model. Below we make high level recommendations for architecture that will need additional scrutiny as the project progresses into detailed design.

Middle Mile Network

Lit and Katapult have determined that in order to build an efficient and robust Last Mile, Fiber-to-the-Premise network, a Middle Mile should be built out especially in parts of the County where no fiber infrastructure exists. This will enable a Last Mile provider to bring ISP services to the residents with less capital expenditure, therefore making the area more competitive for private investment. The Middle Mile was designed focused on connecting anchor institutions and building redundancy into the network. We recommend this Middle Mile network be primarily underground rather than aerial. This portion of the network is the County's life-line and keeps the Middle Mile out of harm's way making for a more secure network.

The Rail Trail Project was strategically incorporated into the overall middle mile ring system designed for the County. The constructed portion of backbone will be approximately 16 miles

long with 144 count fiber starting in York City and is buried along the trail down to New Freedom and has a large portion of ring 5 and 6 are already well on its way to completion.

We recommend a Middle Mile network (and Last Mile) that is scalable and flexible. The strengths of this Middle Mile Network that is being proposed features the following:

- Scalability – Capability to expand geographical service area as well as increased data capacity and integrate next generation technologies.
- Flexibility – Capability to service various client environments and technologies.
- Security – All devices and facilities associated with the network have rigid monitoring and controlled access.
- Capacity – Robust infrastructure to prevent overload of data even at peak congestion.
- Efficiency – Resource allocation and structure designed to be dynamic and operate smoothly.
- Resiliency – Both structurally redundant and physically robust fiber path.

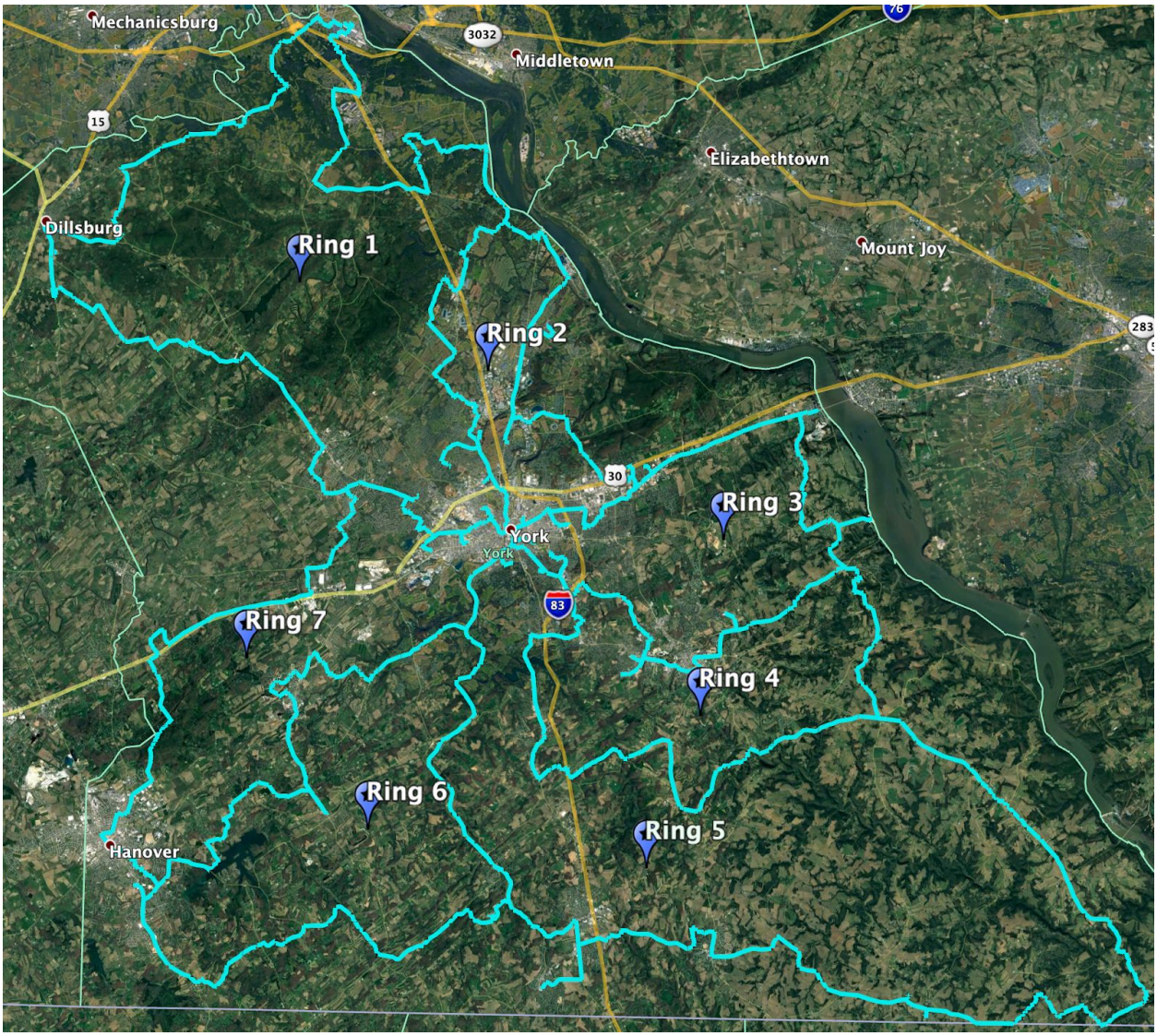
Building out a Middle Mile Network that connects Anchor Institutions is a great first step to bringing high-speed internet to your community. Broadband networks that link to anchor institutions within the community are logical candidates for expansion into nearby neighborhoods. York County provided an extensive list of Anchor Institutions and there was

Networks with redundant ring architecture instantaneously reverse signal direction in the event of a fiber cut along the middle mile, ensuring constant network uptime

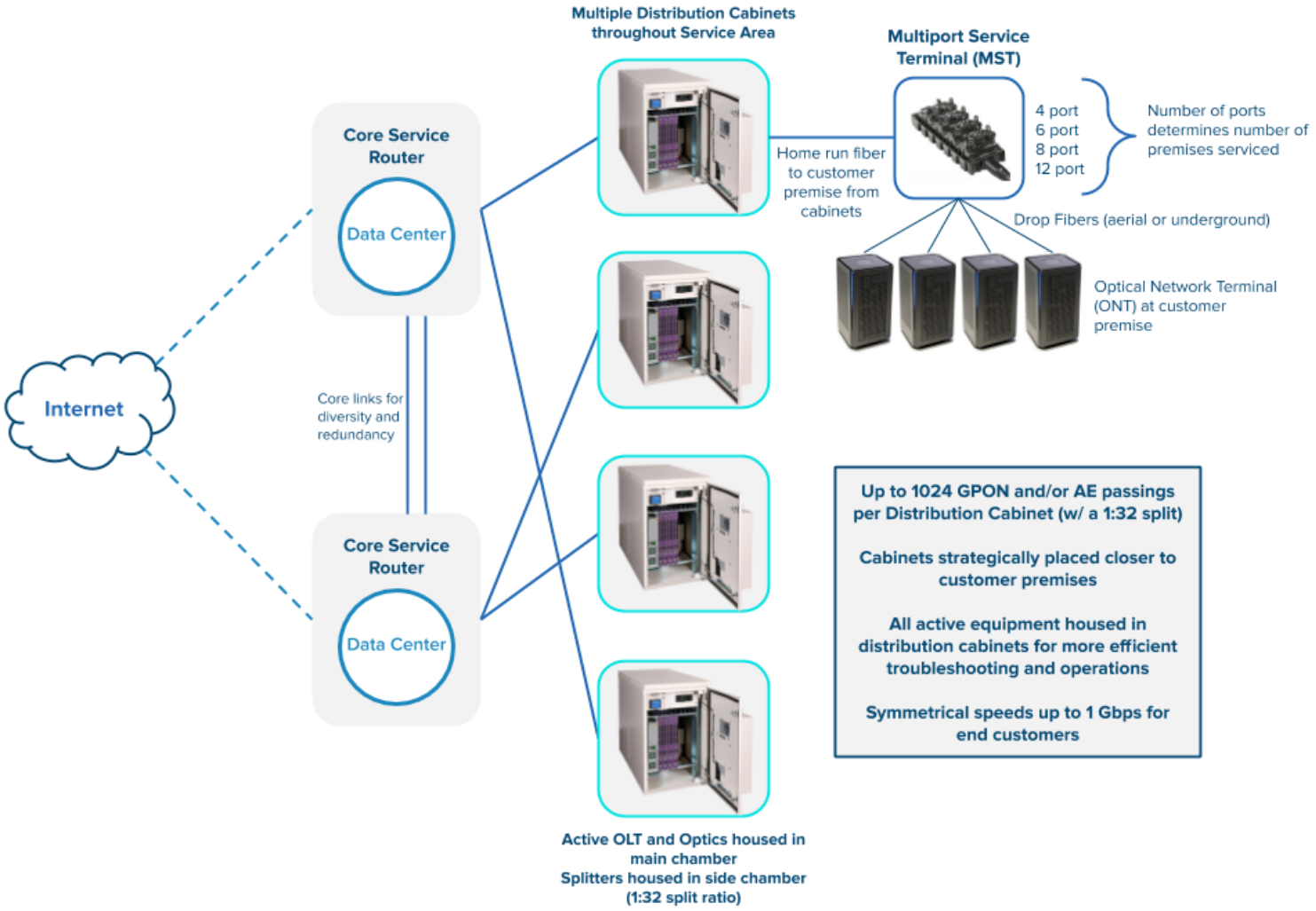
285 included to complete the 333 mile preliminary backbone design. The design includes

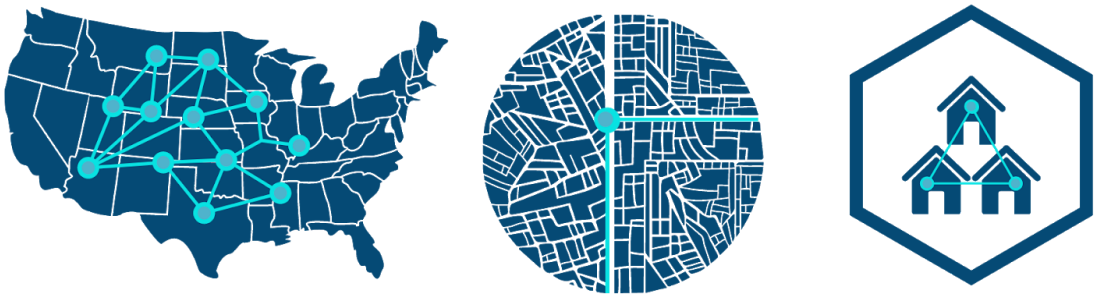
38 Emergency Medical Service facilities, 74 Fire Stations, 33 Police Stations, 121 Schools, and nineteen 911 towers.

Proposed middle mile network from the York's Preliminary Design



Sample Middle Mile Infrastructure

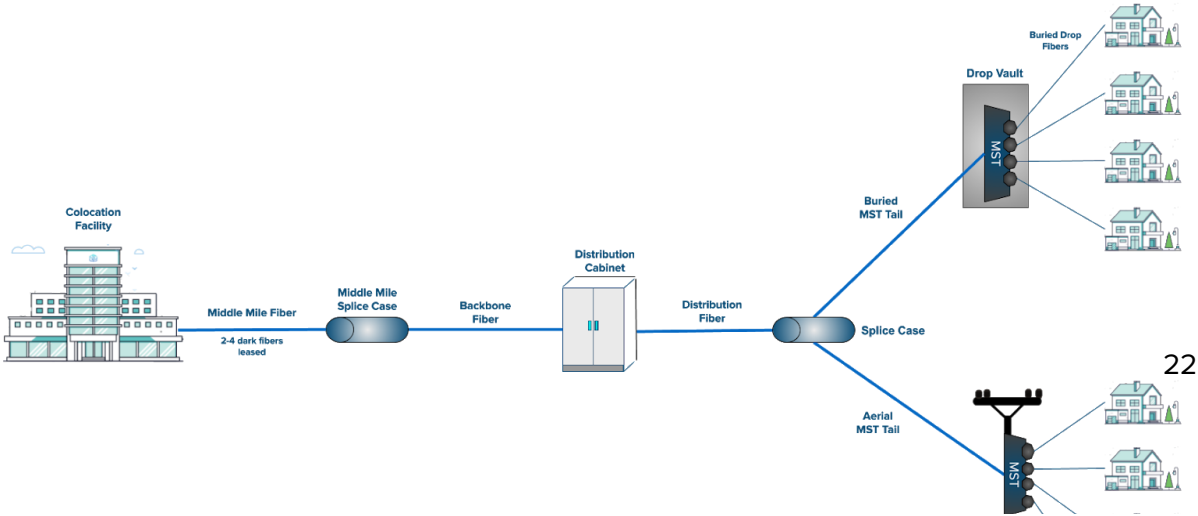




Long Haul | Middle Mile | Last Mile

In order to create connectivity in the Middle Mile network, we recommend connecting to two data centers. Choosing the exact locations of these data centers will take place during the detailed design phase of the project, tips on finding the right spot for your data center can be found in the appendix of this document. This provides geographical diversity and redundancy at the upstream internet provider level. If one data center location goes down, your other site will continue to operate the network. Data centers should be highly secure facilities in a centralized location to your service area with 24x7x365 access for certain personnel. The networks Core Service Routers will be placed in racks in these Data Centers. These sites are where the network will peer with an upstream provider as well as where your interconnections will take place for any service providers wishing to service customers in the service area utilizing this network.

Sample Network Architecture (Full Network including Last Mile)



Last Mile Network (Fiber-to-the-Premise)

The Fiber-to-the-Premise ("FTTP") network was designed to focus on a path (aerial or underground) for construction to each residence and business within the serving boundary of the County.

A high level FTTP design was created for an area that included approximately 50,000 demand points and extrapolated based on those representative demand points to a design that meets York County's connectivity needs and is flexible to a variety of architecture options. The design assumes a 60/40 aerial and underground split for construction based on the Construction Ride Out and Make Ready Engineering Assessment of pole and ground conditions. The designed path was determined by whichever was the most cost effective based on factors gathered in the virtual Construction Ride Out and Make Ready Engineering Assessment.

A hierarchical data network architecture is recommended that is both flexible and scalable. The design will be able to meet additional demand in the future as well as adapt to emerging technologies. The proposed architecture was designed to support multiple network service providers which is one of the hallmarks of an Open Application Network. The proposed

Sample of Last Mile Network from the York's Preliminary Design

architecture will also meet the long term needs and allow for progressive future planning of York County. We recommend a hybrid GPON/ActiveE [1]architecture in which residential subscribers and small to medium businesses are served with GPON, and large businesses and/or enterprise customers receive a direct home run fiber. The difference in GPON and Active-E is that the GPON customer can be connected to the fiber to the home network in a split architecture, whereas Active-E will provide a direct point to point fiber connection (dedicated network) with diversity and redundancy at the business location. Since multiple network design iterations can be run using algorithmically driven software, we recommend using this process to explore exactly how the network should be laid out from a value engineering perspective. This methodology can identify whether a centralized or distributed split GPON architecture would be more cost effective to deploy.

The network architecture recommended includes placement of distribution cabinets throughout the service area which contain both the active electronics such as the Optical Line Terminal (OLT), the optic transceivers, as well as the splitters (1:32 split ratio is recommended to subscribe more customers). By housing this equipment in small distribution cabinets throughout the last mile network, your operations and maintenance, along with troubleshooting, requires less time and cost. These cabinets require either DC or AC power to operate, so placement near a power source is important. The cabinets will be placed along the proposed Middle Mile network tying in and out of that network and utilizing 2-4 fibers to transmit the signal between cabinets, and to and from the data centers where the network will peer with an upstream internet provider. These cabinets service up to 1024 GPON and/or Active-E customers for service up to 1 Gbps. With technologies such as XGS-PON or 10G PON you are able to serve subscribers between 1 and 10 Gbps.

The Last Mile portion of the network starts at the distribution cabinets. From there, distribution fibers will leave the cabinet and will be a direct connection (aka Home Run) to the customer premises. The distribution fibers will only be fusion spliced at splice enclosure locations to tier the fiber down in size as the network branches out from the cabinets into the neighborhoods of the service area. The distribution fiber will terminate at splice enclosures throughout the design and Multiport Service Terminals (MST) will be connected at these

[1] **GPON** = a point-to-multipoint access network. Its main characteristic is the use of passive splitters in the fiber distribution network, enabling one single feeding fiber from the provider to serve multiple homes and small businesses. GPON has a downstream capacity of 2.488 Gb/s and an upstream capacity of 1.244 Gbp/s that is shared among users. **ActiveE** = a dedicated point-to-point access network. ActiveE with very high bit rate services is better suited for medium and large businesses. In the case of Active Ethernet, businesses will have to cover some of the install costs.

locations via a pigtail pre-connected to the MST at the factory. MSTs are recommended to be sized in 4, 6, 8, or 12 ports - this indicates the number of subscribers an MST can service. In certain circumstances it may be beneficial to leave 1 port open in every MST for future Smart City Applications or future growth in an area. The MSTs allow for a 'plug-n-play' drop installation wherein the installation team will plug a drop into 1 port on the MST and run it to the customer premise. This saves on installation times and lowers cost.

The network design assumes standard lateral fiber connections will be terminated within larger businesses with multiple tenants as well as multi-dwelling units such as apartment buildings which is an industry standard best practice. In order to shorten customer activation timelines and greatly reduce the risk of damage to distribution cables and splices, the design assumes terminated fiber tap enclosures in the public right of way or easements. This will help ensure watertight fiber connectors for drop cables connecting customer homes and will eliminate the need for installers to perform splices in the field.

Financial Models

Lit and Katapult completed several 20-year Financial Models based on the results of the Preliminary Design, Construction Ride Out and Make Ready Engineering. The models serve as the backdrop for this Business Plan and recommendation on next steps. We anticipate the Financial Models to continue to evolve as the project progresses through its multiple phases, and also will continue to drive the network through full connectivity. The models were built out using an Open Application Model where there is a single owner and operator of the infrastructure (fiber to the home/business) and then multiple service providers are on the network including internet, voice, TV, telehealth, and smart home applications. The Financial Models are broken out into two distinct categories: Middle Mile and Last Mile, the Last Mile portion is broken out into two parts showing the financial model for the 50,000 demand points and a second extrapolated model that includes the entire County. Even though both the Middle Mile and Last Mile can be built out in conjunction with each other, we thought it important to break it down this way for budgeting, funding and approval processes.

Middle Mile Network

In order to establish a foundation for last mile connectivity for the County, a backbone network will need to be constructed first. Backbone networks typically consist of a ring (or rings) of fiber optic cable connecting different areas of a municipality or region. The ring topology has the advantage to be resilient (redundancy network) against single fiber cuts or other faults. One business opportunity for the County with the backbone ring is connecting local large and mid-sized businesses with internet connectivity.

The County's data sources were utilized in order to analyze GIS and create an initial design for the County's Middle Mile network. From this data, a financial model was created to quantify the cost of building the Middle Mile network and the potential revenue opportunities for the County.

Assumptions

- **Middle Mile Rings & Demand Points:** 7 backbone fiber rings connecting 285 County anchor institutions

Anchor Institutions and Ring Mileage Breakdown						
Ring	EMS	Fire Stations	Police Stations	Schools	911 Towers	Total Connected
Ring 1	8	22	8	33	3	**74**
Ring 2	5	9	6	19	4	**43**
Ring 3	6	12	6	26	3	**53**
Ring 4	3	7	3	6	1	**20**
Ring 5	9	12	5	15	4	**45**
Ring 6	3	8	3	13	2	**29**
Ring 7	4	4	2	9	2	**21**
Total	**38**	**74**	**33**	**121**	**19**	**285**

- **Additional Demand Points & Revenue Opportunities:** We've assumed in addition to the County's 285 anchor institutions that there are opportunities to generate revenue from connecting large to mid sized businesses. We have seen other networks (Medina County Fiber Network in Medina County, OH, Clackamas County, OR and others) leverage this Middle Mile network to connect local businesses and in turn spur economic development with improved connectivity and operations. We are conservatively estimating at least 125 business demand points that could be connected to the County's Middle Mile network.

Demand Points - Anchor Institutes and Businesses	
Anchor Institution Demand Points	285
Business Demand Points	125
Total Demand Points	**410**
Estimated Take Rate	**100%**

- **Right of Way Length of Network and Aerial vs. Underground:** Using the Preliminary Design and pole digitization, we've assumed 100% underground build in the Right of Way

("ROW")[2] for the County's backbone network to be most conservative. An underground network means that fiber cables are buried underground. The cable needs to be buried deep in the ground to protect it from accidental damage – and the deeper the dig the more costly it is. Unforeseen obstacles such as tree roots can dramatically add to costs. If a buried direct cable is broken it is expensive to repair. Direct burying of fiber cables may be resistant to environmental factors (Tornados, heat, rain, soil acidity, etc.), but are much more expensive than aerial fiber optic builds.[3] The County should consider the possibility of incorporating some aerial build into the backbone network for cost savings.

Right of Way Preliminary Design Results	
Aerial Length ROW	0
Underground Length ROW	1,758,029
Existing Aerial ROW	0
Existing Underground ROW	0
Total ROW Length (Feet)	1,758,029
Total ROW Length (Miles)	333

- **Additional Network Assumptions:**

Additional Network Assumptions	
Span Factor	NA
Estimated Pole Count	NA
Cabinets or Shelters	NA
Engineering Duration (months)	35
Make Ready Duration (months)	NA
Construction Duration (months)	35
Financial Duration (months)	240
Take Rate Duration (months)	42

  - Engineering Duration: Total time to complete full design and architecture
  - Construction Duration: Total time to construct network
  - Financial Duration: Total time of financial cash flows
  - Take Rate Duration: Total time until assumed network achieves targeted take rate (connected demand points / total demand points of the network).

[2] *Right of Way: Where fiber is placed; the legal right, established by usage or grant, to pass along a specific route.*
[3] "Key Factors when Choosing between buried and aerial deployments"

Expenses of the Backbone Network

The backbone network deployment is broken up into four major phases including Assessment, Engineering, Construction, and Operations as shown on the 'Expenses' tab of the Financial Model.

1. Assessment

The total costs for the Assessment Phase are assumed to be **$0** since the County will have already paid for the cost of the Broadband Community Assessment.

2. Engineering

The total costs for the Engineering Phase are **$1,774,859** and includes the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost shown below. These tasks will all be completed during months 1-35.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Engineering							
Engineering	Hourly	173	35	1	35	$75.00	$454,125
Local GIS Engineer	Hourly	173	35	1	35	65.00	393,575
Field Designer and Permit Coordinator	Hourly	173	35	1	35	65.00	393,575
Construction Package Creation	Feet	1,758,029	35	1	35	0.04	70,321
Pole Data Field Collection	Pole Count	0	35	1	35	38.00	0
Permit Package Creation	Underground Length	35160.576	35	1	35	0.75	26,370
Biological and Cultural Surveys	Each	1	1	1	1	225,000.00	225,000
Building Inspection & Engineering	Business Demand Points	285	35	1	35	250.00	71,250
BOM & Splice Sheets	Feet	1,758,029	35	1	35	0.08	140,642
			$4,329	$1,774,859			**Total Engineering**

- Engineering- Cost for hiring a firm to continue design and engineering over 35 months.
- Engineering Staff
    - Local GIS Engineer
    - Field Designer and Permit Coordinator
- Construction Package Creation- This task includes two steps: 1) Create drawings for bid packages; 2) Create detailed construction drawings with the General Contractor that gets awarded the construction phase.
- Pole Data Field Collection- This task allows for field collection about aerial poles used for network deployment that cannot be captured remotely. Some tasks that fall within this category include: utility pole attachments and equipment heights, verify geolocation data and pole tag identification, and measuring pole distance from roads and confirming road condition.
- Permit Package Creation- This is to create permits including County, Rail-Road, State DOT as needed based on the routes we select.
- Biological and Cultural Surveys- Biological and cultural resource surveys are conducted during the route planning stage to identify potentially sensitive resources.
- Building Inspection & Engineering- This includes a review that all features and connectivity (including splicing of the fibers) are all accurate. The cables are properly sized and all other QC checkpoints are accurately completed. Routes for constructability would also be reviewed during this task.
- BOM & Splice Sheets- A Bill of Materials will be created that includes blended costs for materials, labor and any additional fees for the project including interconnectivity fees and operations and maintenance costs. This task is to create a Bill of Material and Splice Sheets to complete the overall construction packages for the General Contractor. Initial BOMs for the targeted end users

for bid packages will be created and then create more detailed BOMs based on material vendors used and also the overall structure with the General Contractor for procurement of materials.

3. Construction

The total costs for the Construction Phase are $38,955,802 (less material waste) and includes the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost shown below. The final pricing for this phase will be established during the Engineering Phase, and the Financial Model will be updated accordingly.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Construction							
Make Ready Construction	Miles	0	24	3	26	$12,500.00	$0
ONT Electronics	Demand Points	410	24	2	25	75.00	30,750
ONT Replenishments	Demand Points	410	60	60	119	75.00	15,375
OLT Cabinets and Construction	Cabinets	0	35	2	36	75,000.00	0
OLT Line Cards and Splitters	Cabinets	0	35	2	36	35,000.00	0
Electronics Professional Services	Cabinets	0	35	2	36	23,496.00	0
Electronics Shipping	Cabinets	0	35	2	36	2,700.00	0
Cabinet Shipping	Cabinets	0	35	2	36	4,500.00	0
Underground Construction - Labor	Miles	333	35	4	38	85,000.00	28,301,600
Underground Construction - Materials	Miles	333	35	4	38	23,000.00	7,658,080
Aerial Construction - Labor	Miles	0	35	4	38	23,000.00	0
Aerial Construction - Materials	Miles	0	35	4	38	11,750.00	0
Material Waste	Miles	333	35	4	38	1,737.50	578,518
Director of Construction	Hourly	173	42	1	42	85.00	617,610
Construction Coordinator	Hourly	173	42	3	44	65.00	472,290
Contingency	Months	1	7	4	10	744,038.66	1,860,097
			$6,944	$38,955,802			**Total Construction**

- ONTs- The Optical Network Terminal (“ONT”) is the access endpoint that provides an optical termination at the subscriber premises, and provides subscriber interfaces (Ethernet, POTS, DS1, etc.)
    - ONT Electronics
    - ONT Replenishments
- OLTs- NA for now, we’ve assumed 100% underground.
- Underground Construction- Labor- Cost of construction crews to build the County’s fiber network during underground deployment.
- Underground Construction- Materials- Underground Construction- Materials- Cost of materials including fiber cables, MSTs, drops, vaults, conduit.
- Material Waste- Unwanted or unusable materials
- Construction Personnel:
    - Director of Construction
    - Construction Coordinator
- Contingency- Built in costs in case of construction cost overruns.

4. Operations & Maintenance

The total costs for the Operations & Maintenance Phase before and during the construction period is $1,056,767 and includes the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost shown below. Post construction, the recurring costs for O&M are estimated to be $9,095 every month for the majority of the 20 year period.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Operations							
Travel Expenses	Each	1	35	1	35	5,000.00	$175,000
Technical Maintenance and On-Call - Recurring	Months	236	236	4	239	1,250.00	295,000
Electronics Support	Months	236	236	4	239	2,500.00	590,000
Electronics Training	Months	3	35	4	38	2,900.00	58,000
Electronics Software Supscriptions and Warranties	Months	410	236	4	239	75.00	30,780
Office Administrator	Hourly	173	42	1	42	55.00	399,630
GIS Monthly Services	Months	12	12	1	12	8,000.00	96,000
Fiber Management System - Recurring	Months	239	239	1	239	2,500.00	597,500
Lawyer Fees - Non Recurring	Months	1	1	1	1	35,000.00	35,000
Lawyer Fees - Recurring	Months	238	238	2	239	2,500.00	595,000
Asset Taxes	Months	236	236	4	239	7,791.16	50,943
							Total Operations

- Travel Expenses: Expenses for O&M firm during construction
- Technical Maintenance and On-Call: Cost of firm to do on-call operations and maintenance
- Electronics Support: On-Call support from electronics vendor to troubleshoot and repair any issues.
- Electronics Training: Training for local teams for fiber electronics.
- Electronics Software Subscriptions and Warranties: Software subscription to enhance operations and maintenance of fiber electronics. Additional warranties to pay for any repairs needed.
- Office Administrator: Personnel hired to assist with administrative tasks related to construction and launch of operations and maintenance for the network.
- GIS Monthly Services: GIS mapping and database critical for future technology including smart city innovations, autonomous vehicles, 5G, etc.
- Fiber Management System: Fiber Management system such as VETRO FiberMap used to keep track of the design and database of fiber inventory.
- Lawyer Fees: Cost of hiring lawyers to put together initial agreements for backbone network and minimal ongoing support as needed.
- Asset Taxes: We believe these will be minimal if most likely a public project

ISP expenses

In order to provide internet to anchor institutions and businesses on its backbone, the County will need to implement certain items and we've accounted for these in the ISP-Construction and ISP-Operations sections. Total costs for ISP- Construction totals $1,099,545 and will cover expenses related to electronics, underground installation, inside plant materials, and electronics and router installation for backhaul at NOC locations. Total costs for ISP-Operations are $254,470 during the first four months and $19,600 per month thereafter.

Phase	Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
	ISP - Construction							
Construction ISP	Electronics - post ONT including gateway/router	Demand Points	410	6	25	30	$149.00	$61,090
Construction ISP	Aerial Full Installation	Demand Points	0	61	11	71	400.00	0
Construction ISP	Underground Full Installation	Demand Points	410	61	11	71	575.50	235,955
Construction ISP	Inside Plant Materials	Demand Points	410	6	25	30	250.00	102,500
Construction ISP	Electronics Router and Installation	NOC Locations	2	1	3	3	350,000.00	700,000
					$1,099,545			**Total ISP - Construction**
	ISP - Operations							
Operations ISP	Backhaul and transit services	Months	237	237	3	239	8,000.00	$1,896,000
Operations ISP	Network Operations Center - Base Monthly Fee	Months	237	237	3	239	4,850.00	1,149,450
Operations ISP	Network Operations Center - New Service Onboarding	Months	4	1	3	3	4,755.00	19,020
Operations ISP	Pre-Marketing and Local Support Startup	Months	4	4	1	4	45,000.00	180,000
Operations ISP	Recurring Marketing Fees	Months	235	235	5	239	3,500.00	822,500
Operations ISP	Insurance Setup	Months	1	1	1	1	20,000.00	20,000
Operations ISP	Insurance Premiums	Months	238	238	2	239	3,250.00	773,500
								Total ISP - Operations

Options for building out the Middle Mile network

Within the financial model a breakdown of costs for Rings 1-7 were provided for the Middle Mile network in order to potentially phase in and build each ring individually. Below is the breakdown of these engineering and construction costs:

Ring	ROW Miles	Engineering Costs ($)	Construction Costs ($)
Ring 1	88.93	$689,227	$10,247,014
Ring 2	27.46	$406,858	$3,276,316
Ring 3	43.45	$480,310	$5,089,582
Ring 4	33.86	$436,257	$4,002,076
Ring 5	64.41	$576,638	$7,467,580
Ring 6	45.34	$488,992	$5,303,908
Ring 7	29.5	$416,229	$3,507,652
TOTAL	332.95	$3,494,511	$38,894,128

Note: Total costs for 7 ring buildouts will differ from the total backbone construction costs slightly due to additional business customers being factored into the backbone financial model and excludes operational and maintenance costs.

Services

In the table below, we've assumed the following:

- **FTTH Partner:** Once the County has its first Middle Mile network ring operational, it can appoint a partner to design, engineer, construct, and operate/maintain a last-mile or FTTH network to connect residential and small businesses in York county. The County can charge the FTTH partner a cost per demand point connected for middle mile connection. For the purposes of this analysis, we assumed $5 per demand point and in the County's last-mile network there are 201,500 residents and small businesses.
- **Internet for Businesses:** The County can connect large to mid sized businesses with fiber internet. We've seen municipalities like Medina County, OH build a middle mile backbone and connect businesses with fiber. Medina County has been able to use this revenue to pay the debt service on the bonds they took out initially to construct their middle mile network. We've assumed there would be two technology options for internet

connections- GPON and ActiveE. With fiber, the County will be able to provide fast, symmetrical internet to businesses. For each of the line items, the first number indicates download speeds in Mbps and the second number indicates upload speeds in Mbps.

  - GPON = a point-to-multipoint access network. Its main characteristic is the use of passive splitters in the fiber distribution network, enabling one single feeding fiber from the provider to serve multiple homes and small businesses. GPON has a downstream capacity of 2.488 Gb/s and an upstream capacity of 1.244 Gbp/s that is shared among users.
  - ActiveE = a dedicated point-to-point access network. ActiveE with very high bit rate services is better suited for medium and large businesses. In the case of Active Ethernet, businesses will have to cover some of the install costs.

- **Dark Fiber Lease Ring:** The County can earn additional revenue by entering into partnerships with public and private entities to lease them fibers on the County's Middle Mile network for connectivity. This connectivity will allow for public and private entities to embark on technologies including 5G and smart city innovations.

Revenue	Cost	Unit of Measure	Units	Total
Fiber-to-the-Home Partner	$5.00	Demand Points	201,500	$98,717,845
100/100 Business - GPON	$99.99	Businesses	125	5%
250/250 Business - GPON	$269.99	Businesses	125	5%
1000/1000 Business - GPON	$349.99	Businesses	125	10%
250/250 Business - ActiveE	$299.99	Businesses	125	30%
1000/1000 Business - ActiveE	$699.99	Businesses	125	50%
Dark Fiber Lease Ring 1	$1,000.00	Mile	89	$88,930
Dark Fiber Lease Ring 2	$1,000.00	Mile	27	$27,460
Dark Fiber Lease Ring 3	$1,000.00	Mile	43	$43,450
Dark Fiber Lease Ring 4	$1,000.00	Mile	34	$33,860
Dark Fiber Lease Ring 5	$1,000.00	Mile	64	$64,420
Dark Fiber Lease Ring 6	$1,000.00	Mile	45	$45,340
Dark Fiber Lease Ring 7	$1,000.00	Mile	30	$29,500

Projections

In the County's Middle Mile financial model, we show on the "Model" tab cash flow projections for the 20-year period of the project. A screenshot of the tab is shown below which captures the revenues, expenses, EBITDA, capital expenditures, debt financing, and cash flows after financing costs. This model currently assumes 100% debt financing, which is subject to conversations with the County and capital raise requirements.

		1	2	3	4	5	6	7	8	9	10
		12/31/2021	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026	12/31/2027	12/31/2028	12/31/2029	12/31/2030
($ in USD)		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Revenue											
FTTH Partner		$0	$911,345	$2,375,375	$3,335,515	$4,083,275	$4,665,640	$5,119,165	$5,472,385	$5,747,470	$5,961,710
Services Revenue		$0	$96,231	$273,887	$451,543	$629,200	$739,001	$740,235	$740,235	$740,235	$740,235
Dark Fiber Leases		$0	$1,094,620	$1,440,130	$1,951,940	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520
Total Revenue		**$0**	**$2,102,196**	**$4,089,392**	**$5,738,998**	**$8,707,995**	**$9,400,161**	**$9,854,920**	**$10,208,140**	**$10,483,225**	**$10,697,465**
Operating Expenses											
General Operations (Ongoing)		381,563	311,202	303,202	180,712	109,136	109,136	109,136	109,136	109,136	109,136
ISP Operations (Ongoing)		391,670	235,200	235,200	235,200	235,200	235,200	235,200	235,200	235,200	235,200
Total Expenses		**$773,233**	**$546,402**	**$538,402**	**$415,912**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**
EBITDA		**($773,233)**	**$1,555,794**	**$3,550,990**	**$5,323,086**	**$8,363,659**	**$9,055,825**	**$9,510,584**	**$9,863,804**	**$10,138,889**	**$10,353,129**
% margin			*74.0%*	*86.8%*	*92.8%*	*96.0%*	*96.3%*	*96.5%*	*96.6%*	*96.7%*	*96.8%*
Capital Expenditures											
Assessment (Upfront)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Engineering (Upfront)		712,099	531,380	531,380	0	0	0	0	0	0	0
Construction (Upfront)		10,487,457	12,854,157	12,841,345	3,335,986	0	3,075	3,075	3,075	3,075	3,075
ISP Construction (Upfront)		703,868	46,417	210,007	46,417	46,417	46,417	0	0	0	0
Total Capital Expenditures		**$11,903,424**	**$13,431,955**	**$13,582,732**	**$3,382,403**	**$46,417**	**$49,492**	**$3,075**	**$3,075**	**$3,075**	**$3,075**
Unlevered Free Cash Flow		**($12,676,657)**	**($11,876,161)**	**($10,031,742)**	**$1,940,683**	**$8,317,241**	**$9,006,333**	**$9,507,509**	**$9,860,729**	**$10,135,814**	**$10,350,054**
Interest Expense		(1,020,009)	(981,027)	(940,858)	(899,468)	(856,819)	(812,873)	(767,590)	(720,930)	(672,850)	(623,308)
Debt BoP		$34,584,560	$33,302,907	$31,982,272	$30,621,469	$29,219,276	$27,774,433	$26,285,644	$24,751,573	$23,170,841	$21,542,029
Debt Amort		(1,281,652)	(1,320,635)	(1,360,803)	(1,402,193)	(1,444,843)	(1,488,789)	(1,534,072)	(1,580,732)	(1,628,811)	(1,678,353)
Debt EoP	**$34,584,560**	**$33,302,907**	**$31,982,272**	**$30,621,469**	**$29,219,276**	**$27,774,433**	**$26,285,644**	**$24,751,573**	**$23,170,841**	**$21,542,029**	**$19,863,676**
Cash Flows		($14,978,319)	($14,177,823)	($12,333,404)	($360,979)	$6,015,580	$6,704,671	$7,205,847	$7,559,067	$7,834,152	$8,048,392

		10	11	12	13	14	15	16	17	18	19	20
		12/31/2030	12/31/2031	12/31/2032	12/31/2033	12/31/2034	12/31/2035	12/31/2036	12/31/2037	12/31/2038	12/31/2039	12/31/2040
($ in USD)		2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Revenue												
FTTH Partner		$5,961,710	$6,096,645	$6,105,480	$6,105,480	$6,105,480	$6,105,480	$6,105,480	$6,105,480	$6,105,480	$6,105,480	$6,105,480
Services Revenue		$740,235	$740,235	$740,235	$740,235	$740,235	$740,235	$740,235	$740,235	$740,235	$740,235	$740,235
Dark Fiber Leases		$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520	$3,995,520
Total Revenue		**$10,697,465**	**$10,832,400**	**$10,841,235**	**$10,841,235**	**$10,841,235**	**$10,841,235**	**$10,841,235**	**$10,841,235**	**$10,841,235**	**$10,841,235**	**$10,841,235**
Operating Expenses												
General Operations (Ongoing)		109,136	109,136	109,136	109,136	109,136	109,136	109,136	109,136	109,136	109,136	109,136
ISP Operations (Ongoing)		235,200	235,200	235,200	235,200	235,200	235,200	235,200	235,200	235,200	235,200	235,200
Total Expenses		**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**	**$344,336**
EBITDA		**$10,353,129**	**$10,488,064**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**
% margin		*96.8%*	*96.8%*	*96.8%*	*96.8%*	*96.8%*	*96.8%*	*96.8%*	*96.8%*	*96.8%*	*96.8%*	*96.8%*
Capital Expenditures												
Assessment (Upfront)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Engineering (Upfront)		0	0	0	0	0	0	0	0	0	0	0
Construction (Upfront)		3,075	0	0	0	0	0	0	0	0	0	0
ISP Construction (Upfront)		0	0	0	0	0	0	0	0	0	0	0
Total Capital Expenditures		**$3,075**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Unlevered Free Cash Flow		**$10,350,054**	**$10,488,064**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**	**$10,496,899**
Interest Expense		(623,308)	(572,260)	(519,658)	(465,457)	(409,607)	(352,058)	(292,759)	(231,657)	(168,695)	(103,819)	(36,970)
Debt BoP		$21,542,029	$19,863,676	$18,134,274	$16,352,270	$14,516,065	$12,624,011	$10,674,407	$8,665,505	$6,595,500	$4,462,533	$2,264,691
Debt Amort		(1,678,353)	(1,729,402)	(1,782,003)	(1,836,205)	(1,892,055)	(1,949,603)	(2,008,902)	(2,070,005)	(2,132,966)	(2,197,843)	(2,264,692)
Debt EoP	**$34,584,560**	**$19,863,676**	**$18,134,274**	**$16,352,270**	**$14,516,065**	**$12,624,011**	**$10,674,407**	**$8,665,505**	**$6,595,500**	**$4,462,533**	**$2,264,691**	**($1)**
Cash Flows		$8,048,392	$8,186,402	$8,195,237	$8,195,237	$8,195,237	$8,195,237	$8,195,237	$8,195,237	$8,195,237	$8,195,237	$8,195,237

For the 20 year period of the County's Middle Mile financial model projections, we are predicting an IRR of approximately 12%. This is subject to further strategy, structuring, and conversations with the County and its financial advisor.

Last Mile / Fiber-to-the-Premise ("FTTP") Partner Network 50k demand points

Assumptions

- **Demand Points:** The County contracted Lit and Katapult to perform autodesign on approximately 50,000 representative demand points in the County. The County provided

Lit and Katapult with local address data, from which an automated design was created to obtain preliminary metrics and data for an FTTP network. From the County's autodesign, Lit and Katapult defined a preliminary service area - deriving 51,144 potential residential customers and 725 potential small business customers, for a grand total of 51,869 total customers or demand points. Several diverse areas were chosen which were most representative of York County's make up. The selected areas ranged from rural to urban to get the most accurate representative make up.

Demand Points[4] - Homes and Businesses	
Residential Demand Points	51,144
Business Demand Points	725
Total Demand Points	**51,869**
Estimated Take Rate[5]	**55%**

- **Right of Way Length of Network and Aerial vs. Underground:** Using the Preliminary Design and pole digitization, we've assumed 65% aerial and 35% underground build in the Right of Way ("ROW")[6] for the County's FTTH Partner network based on the findings during the Construction Ride Out and Make Ready Engineering Assessment. Aerial deployment typically is one of the most cost effective methods of deploying fiber to customers, because of the ability to leverage existing pole lines and avoiding additional costs of digging up roads or burying cables. An underground network means that fiber cables are buried underground. The cable needs to be buried deep in the ground to protect it from accidental damage – and the deeper we have to dig the more costly it is. Unforeseen obstacles such as tree roots can dramatically add to costs. If a buried direct cable is broken it is expensive to repair. Direct burying of fiber cables may be resistant to environmental factors (hurricanes, heat, rain, soil acidity, etc.), but are much more expensive than aerial fiber optic builds.[7]

Right of Way Preliminary Design Results	
Aerial Length ROW	2,899,834
Underground Length ROW	1,561,449
Existing Aerial ROW	0
Existing Underground ROW	0
Aerial Length ROW	2,899,834
Underground Length ROW	1,561,449

- **Additional Network Assumptions:**

[4] *Demand Points: Number of potential residential, commercial, and wireless connections.*
[5] *Take Rate: Connected demand points / total demand points of the network.*
[6] *Right of Way: Where fiber is placed; the legal right, established by usage or grant, to pass along a specific route.*
[7] "Key Factors when Choosing between buried and aerial deployments"

Additional Network Assumptions	
Span Factor	100
Estimated Pole Count	28,998
Cabinets or Shelters	51
Engineering Duration (months)	48
Make Ready Duration (months)	36
Construction Duration (months)	48
Financial Duration (months)	240
Take Rate Duration (months)	60

- Span factor: Average length between poles on site
- Estimated pole count: Total utility poles based on pole digitization and auto design
- Cabinets or shelters: Structure where electronics are held
- Engineering Duration: Total time to complete full design and architecture
- Make Ready Duration: Total time to prepare existing poles for fiber attachments (planning, measurements, permitting, making space on poles for new fiber)
- Construction Duration: Total time to construct network
- Financial Duration: Total time of financial cash flows
- Take Rate Duration: Total time until assumed network achieves targeted take rate (connected demand points / total demand points of the network).

Expenses of the Last Mile/FTTP Partner Network 50k per Phase

The network deployment is broken up into four major phases including Assessment, Engineering, Construction, and Operations as shown on the "Expenses" tab of the Financial Model. Much of these costs could be assumed by parties other than the County if the County chooses to lease access to the middle mile and/ or work with a partner to build out the last mile.

1. Assessment

The total costs for the Assessment Phase are assumed to be $0 since the County will have already paid for the cost of the Broadband Community Assessment.

2. Engineering

The total costs for the Engineering Phase are $8,569,870 and includes the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost shown below. These tasks will all be completed during months 1-48.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Engineering							
Director of Engineering	Hourly	173	48	1	48	$68.00	$564,672
Senior Network Designer	Hourly	173	48	1	48	55.00	456,720
Senior Network Designer	Hourly	173	48	1	48	55.00	456,720
Field Engineer and Permit Coordinator	Hourly	173	48	1	48	50.00	415,200
Core Network Engineering Consulting Services	Hourly	173	2	1	2	250.00	86,500
Pole Data Collection Field	Poles	28,998	48	1	48	38.00	1,101,937
Construction Package Creation	Feet	4,461,283	48	1	48	0.04	178,451
Permit Package Creation	Underground Length	1,561,449	48	1	48	0.75	1,171,087
Permit Fees	Each	2,231	48	1	48	125.00	278,830
Building Inspection & Engineering	Business Demand Points	725	48	1	48	250.00	181,250
BOM & Splice Sheets	Feet	4,461,283	48	1	48	0.08	356,903
CEO or General Manager	Hourly	173	240	1	240	80.00	3,321,600
				$8,569,870			**Total Engineering**

- Engineering Staff
    - Local Engineering Project Manager
    - Local GIS Engineer
    - Field Designer and Permit Coordinator
- Construction Package Creation- This task includes two steps: 1) Create drawings for bid packages; 2) Create detailed construction drawings with the General Contractor that gets awarded the construction phase.
- Pole Data Field Collection- This task allows for field collection about aerial poles used for network deployment that cannot be captured remotely. Some tasks that fall within this category include: utility pole attachments and equipment heights, verify geolocation data and pole tag identification, and measuring pole distance from roads and confirming road condition.
- Permit Package Creation- This is to create permits including County, Rail-Road, State DOT as needed based on the routes we select.
- Biological and Cultural Surveys- Biological and cultural resource surveys are conducted during the route planning stage to identify potentially sensitive resources.
- Building Inspection & Engineering- This includes a review that confirms all features and connectivity (including splicing of the fibers) are accurate. The cables are properly sized and all other QC checkpoints are accurately completed. Routes for constructability would also be reviewed during this task.
- BOM & Splice Sheets- A Bill of Materials will be created that includes blended costs for materials, labor and any additional fees for the project including interconnectivity fees and operations and maintenance costs. This task is to create a Bill of Material and Splice Sheets to complete the overall construction packages for the General Contractor. Initial BOMs for the targeted end users for bid packages will be created and then more detailed BOMs will be created based on material vendors used and the General Contractor's procurement of materials.

3. Construction

The total costs for the Construction Phase are $72,139,028 (less material waste) and includes the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost shown below. The final pricing for this phase will be established during the Engineering Phase, and the Financial Model will be reflected accordingly.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Construction							
Make Ready Construction	Miles	549	36	3	38	$12,500.00	$6,865,138
Optical Network Terminal	Demand Points	33715	24	2	25	75.00	2,528,614
Optical Network Terminal Replishments	Demand Points	33715	112	120	231	75.00	1,264,307
Distribution Cabinets	Cabinets	51	48	2	49	41,135.08	2,083,628
Cabinet Shipping	Cabinets	51	48	1	48	4,041.00	204,690
ONT Shipping	Cabinets	48	48	1	48	2,698.21	128,291
Distribution Splitters	Cabinets	51	48	2	49	28,633.00	1,450,357
Cabinet Electronics	Cabinets	51	48	2	49	23,946.50	1,212,970
Cabinet Electronics Replenishments	Cabinets	51	48	120	167	23,946.50	1,212,970
Cabinet Electronics Professional Services	Each	51	48	2	49	33,560.00	1,699,925
Underground Construction - Labor	Miles	296	48	5	52	84,094.31	24,869,125
Underground Construction - Materials	Miles	296	48	1	48	23,172.60	6,852,809
Aerial Construction - Labor	Miles	549	48	5	52	20,705.17	11,371,507
Aerial Construction - Materials	Miles	549	48	1	48	13,093.36	7,191,016
Material Waste	Miles	844.94	48	1	48	1,963.30	1,658,869
As built updates & turnover	Feet	4,461,283	48	2	49	0.18	803,031
Director of Construction	Hourly	173	60	1	60	53.00	550,140
Project Coordinator	Hourly	173	57	4	60	45.00	443,745
Contingency	Months	1	48	1	48		1,447,823
				$72,139,028			**Total Construction**

- Make Ready Construction- This task is to complete the Make Ready Construction work on utility poles for the future placement of the strand of the aerial fiber placement.
- ONTs- The Optical Network Terminal (“ONT”) is the access endpoint that provides an optical termination at the subscriber premises, and provides subscriber interfaces (Ethernet, POTS, DS1, etc.).
    - ONT Electronics
    - ONT Replenishments
- OLTs- The Optical Line Terminal (“OLT”) is the access node that provides GPON network terminations.
    - OLT Cabinets and Construction- OLT cabinet is the physical building to put equipment in. These can come pre-fabricated or can be a new structure the community decides to build.
    - OLT Line Cards and Splitters
- Electronics Professional Services- Additional services that may be performed by an electronics provider.
- Shipping
    - Electronics Shipping- Cost of sending electronics from warehouse to Oldham County.
    - Cabinet Shipping- Cost of sending cabinets from warehouse to Oldham County.
- Underground Construction- Labor- Cost of construction crews to build the County’s fiber network during underground deployment.
- Underground Construction- Materials- Cost of materials including fiber cables, MSTs, drops, vaults, conduit.
- Aerial Construction- Labor- Cost of construction crews to build the County’s fiber network during aerial deployment.
- Aerial Construction- Materials- Cost of materials including fiber cables, MSTs, strands, lashing wires, splice closures.
- Material Waste- Unwanted or unusable materials
- Construction Personnel:
    - Director of Construction
    - Construction Coordinator
- Contingency- Built in costs in case of construction cost overruns.

4. Operations & Maintenance

The total costs for the Operations & Maintenance before and during the construction period is $10,408,494. Post construction, the recurring monthly costs are estimated to be on average $263,289 and will be covered entirely by revenue generated from the network. See below for the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Operations							
Employee Laptops and Desk Equipment	Each	9	2	1	2	$2,500.00	$22,500
Employee Software - Adobe, Office, etc.	Each	240	240	1	240	1,350.00	$324,000
Travel Expenses	Each	1	48	1	48	5,000.00	$240,000
Moving Expenses	Each	3	2	1	2	12,000.00	$36,000
Company Truck for Director of Construction	Months	40	40	1	40	2,200.00	$88,000
Vehicle Per Diem during Engineering and Construction	Months	80	40	1	40	500.00	$40,000
O&M Project Management	Months	239	239	2	240	5,400.00	1,290,600
Maintenance Incident Repair During Construction	Incidents	16	48	1	48	525.00	8,400
Maintenance Incident Repair Post Construction	Incidents	136	183	37	219	900.00	122,400
Calix Essential Support Entitlement	Each	239	239	2	240	5,995.00	119,400
Calix Training Subscription	Each	5	3	2	4	2,940.00	14,700
ONT Subsciber Annual Term License - up to 1000	Demand Points Connected	1000	N/A	N/A	N/A	4.99	0
ONT Subsciber Annual Term License - 1000 -2,499 subscriptic	Demand Points Connected	2499	N/A	N/A	N/A	3.30	1,321
ONT Subsciber Annual Term License - 2,500-4,999 subscripti	Demand Points Connected	4999	N/A	N/A	N/A	2.59	3,133
ONT Subsciber Annual Term License - 5,000- 9,999 subscripti	Demand Points Connected	9999	N/A	N/A	N/A	2.16	60,495
ONT Subsciber Annual Term License - 10,000 - 24,999 subscr	Demand Points Connected	24999	N/A	N/A	N/A	1.95	913,479
Router Subscription: 50-249 Customers	Demand Points Connected	249	N/A	N/A	N/A	10.50	0
Router Subscription: 250 - 999 Customers	Demand Points Connected	999	N/A	N/A	N/A	7.00	504
Router Subscription: 1000 - 4,999 Customers	Demand Points Connected	4999	N/A	N/A	N/A	5.25	2,614,479
Cabinet Electronics Warranty (every 5 years)	Each	51	177	55	231	274.80	4,640
Home Electronics Warranty (every 5 years)	Each	28528	177	55	231	40.32	383,416
Marketing Manager	Hourly	173	240	1	240	45.00	1,868,400
OSS/BSS Software - Setup - Development	Months	1	1	1	1	135,000.00	135,000
OSS/BSS Software - Recurring	Demand Points	28528	N/A	N/A	N/A	1.00	5,976,816
GIS Monthly Services	Months	48	24	1	24	8,000.00	384,000
Construction Management Software	Months	237	237	4	240	299.00	70,863
Fiber Management System - Recurring	Months	240	240	1	240	2,500.00	600,000
GIS and OSS/BSS Integration	Each	1	1	1	1	30,000.00	30,000
Pole Attachment Fees	Poles	28,998	237	4	240	12.00	6,872,607
Middle Mile Network Fee	Subscriptions	28528	N/A	N/A	N/A	5.00	31,167,839
Stripe ACH Fees - Recurring	Demand Points Connected	28528	N/A	N/A	N/A	0.50	1,494,204
Plaid Fees - Recurring	Demand Points Connected	28528	N/A	N/A	N/A	0.10	298,841
Lawyer Fees - Non Recurring	Months	1	1	1	1	35,000.00	35,000
Lawyer Fees - Recurring	Months	239	239	2	240	5,500.00	1,314,500
Network Insurance	Months	239	239	2	240	12,500.00	2,987,500
Pole Repairs	Months	1450	204	37	240	250.00	362,479
							Total Operations
							Total Expenses (non-ISP)

- Employee Laptops and Desk Equipment- Laptops and desk equipment for employees of the network.
- Employee Software- Adobe, Office, etc.- Computer software for network employees.
- Travel Expenses- Travel expenses to/from the market
- Moving Expenses- Relocation fees for employees of the network to move locally.
- Technical Maintenance and On-Call Recurring- Operations and maintenance for technical support
- Electronics Support-On-Call support from an electronics vendor to troubleshoot and repair any issues.
- Electronics Training-Training for local teams on fiber electronics.
- Electronics Software Subscriptions and Warranties-Software subscription to enhance operations and maintenance of fiber electronics. Additional warranties to pay for any repairs needed.
- Office Administrator-Personnel hired to assist with administrative tasks related to construction and launch of operations and maintenance for the network.
- Neighborhood Coordinator- Person overseeing local grassroots marketing, coordinating Fiber MVPs/Champions, fiberhood deployment, and assisting with community relations during construction.

- Marketing Administrator- Person overseeing marketing of the network. Responsibilities include: short and long term marketing and branding strategies, advertising campaigns, and local engagement.
- Financial Manager- Cost of personnel for managing the finances of the network. The financial manager is responsible for accounting, financial statements, and business reporting.
- OSS/BSS Software - Setup - Development- Cost to set up the operations and billing software system which facilitates customer orders, billing, workflow, analytics, and other network needs.
- OSS/BSS Software - Recurring- Ongoing cost for operations and billing software system which facilitates customer orders, billing, workflow, analytics, and other network needs.
- GIS Monthly Services- GIS mapping and database critical for future technology including smart city innovations, autonomous vehicles, 5G, etc.
- Fiber Management System- Fiber Management system such as VETRO FiberMap used to keep track of the design and database of fiber inventory.
- Middle Mile Connection- Middle Mile fiber connectivity to light the last mile network. In this case, we would connect this to the County's backbone network. If the City owns the backbone network, they would be collecting these fees.

ISP expenses

In order to provide internet to residents and small businesses, the FTTP partner will need to implement certain items and we've accounted for these in the ISP-Construction and ISP-Operations sections.

	ISP - Construction							
Construction ISP	Electronics - WiFi Router	Subscriptions	28528	N/A	N/A	N/A	$149.25	$4,257,797
Construction ISP	Electronics - WiFi Router Replenishment	Subscriptions	28528	123	120	240	149.25	3,193,347
Construction ISP	Aerial Full Installation	Subscriptions	18543	N/A	N/A	N/A	365.50	6,777,528
Construction ISP	Underground Full Installation	Subscriptions	9985	N/A	N/A	N/A	475.50	4,747,764
Construction ISP	Aerial Full Installation - churn portion	Subscriptions	N/A	N/A	N/A	N/A	365.50	182,322
Construction ISP	Underground Full Installation - churn portion	Subscriptions	N/A	N/A	N/A	N/A	475.50	127,720
Construction ISP	Inside Plant Materials	Subscriptions	28528	N/A	N/A	N/A	30.00	855,839
Construction ISP	ISP Materials Warehouse Manager	Hourly	173	2	3	4	37.50	12,975
Construction ISP	Router and Installation - 1st Datacenter	NOC Locations	1	1	3	3	250,000.00	250,000
Construction ISP	Router and Installation - 2nd Datacenter	NOC Locations	1	1	8	8	250,000.00	250,000
Construction ISP	1st Data Center Electronics	Each	1	1	3	3	24,347.00	24,347
Construction ISP	2nd Data Center Electronics	Each	1	1	8	8	24,347.00	24,347
					$20,703,985			**Total ISP - Construction**

ISP - Operations							
Backhaul and transit services - (20G Circuit)	Months	12	12	3	14	10,800.00	$129,600
Backhaul and transit services - (40G Circuit)	Months	12	12	15	26	19,440.00	233,280
Backhaul and transit services - (100G Circuit)	Months	214	214	27	240	29,160.00	6,240,240
Backhaul and transit services - 10G or 20G (2nd/backup)	Months	233	233	8	240	10,800.00	2,516,400
Backhaul and transit services - 1st Colocation	Months	238	238	3	240	600.00	142,800
Backhaul and transit services - 2nd Colocation	Months	233	233	8	240	850.00	198,050
Network Operations Center - Phase 1	Months	5	5	4	8	1,698.00	8,490
Network Operations Center - Phase 2	Months	7	7	9	15	2,523.00	17,661
Network Operations Center - Phase 3	Months	5	5	16	20	3,513.00	17,565
Network Operations Center - Phase 4	Months	5	5	21	25	4,933.00	24,665
Network Operations Center - Phase 5	Months	8	8	22	29	6,583.00	52,664
Network Operations Center - Phase 6	Months	211	211	30	240	7,738.00	1,632,718
Marketing Startup Budget	Months	9	9	1	9	23,774.44	213,970
Local Marketing Consultant	Months	240	240	1	240	2,500.00	600,000
Digital Advertising	Months	240	240	1	240	1,000.00	240,000
Marketing Cloud Services	Each	1	1	1	1	127,865.00	127,865
Sales Associate	Hourly	173	238	3	240	25.00	1,029,350
Sales Associate	Hourly	173	238	3	240	25.00	1,029,350
Sales Associate	Hourly	173	233	8	240	25.00	1,007,725
Sales Associate	Hourly	173	233	8	240	25.00	1,007,725
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Demonstration Center Setup	Months	2	2	1	2	100,000.00	200,000
Demonstration Center and Local Office Recurring	Months	238	238	3	240	5,000.00	1,190,000
Insurance Setup	Months	1	2	1	2	30,000.00	30,000
Insurance Premiums	Months	239	239	2	240	12,500.00	2,987,500
				$28,700,678			**Total ISP - Operations**

Projections

In the FTTH Partner financial model, we show on the “Model” tab cash flow projections for the 20-year period of the project. A screenshot of the tab is shown below which captures the revenues, expenses, EBITDA, capital expenditures, debt financing, and cash flows after financing costs. This model currently assumes majority equity financing and partial debt financing after the project reaches a permanent period.

		1	2	3	4	5	6	7	8	9	10
		12/31/2021	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026	12/31/2027	12/31/2028	12/31/2029	12/31/2030
($ in USD)		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Revenue											
Services Revenue		$0	$6,325,493	$17,904,918	$24,726,252	$29,342,196	$32,574,333	$34,196,699	$35,066,107	$35,935,514	$36,804,922
Other Revenue		0	0	0	0	0	0	0	0	0	0
Total Revenue		**$0**	**$6,325,493**	**$17,904,918**	**$24,726,252**	**$29,342,196**	**$32,574,333**	**$34,196,699**	**$35,066,107**	**$35,935,514**	**$36,804,922**
Operating Expenses											
General Operations (Ongoing)		424,129	1,587,551	2,408,307	2,739,617	2,994,519	3,137,013	3,195,755	3,195,755	3,195,755	3,195,755
ISP Operations (Ongoing)		522,608	1,226,878	1,325,768	1,441,506	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816
Total Expenses		**$946,738**	**$2,814,429**	**$3,734,075**	**$4,181,123**	**$4,438,335**	**$4,580,829**	**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,639,571**
EBITDA		**($946,738)**	**$3,511,064**	**$14,170,843**	**$20,545,128**	**$24,903,861**	**$27,993,504**	**$29,557,128**	**$30,426,536**	**$31,295,944**	**$32,165,351**
% margin			*55.5%*	*79.1%*	*83.1%*	*84.9%*	*85.9%*	*86.4%*	*86.8%*	*87.1%*	*87.4%*
Capital Expenditures											
Assessment (Upfront)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Engineering (Upfront)		450,631	1,456,522	1,456,522	1,456,522	1,133,912	166,080	166,080	166,080	166,080	166,080
Construction (Upfront)		1,823,721	18,244,631	18,788,926	17,544,639	14,052,160	907,599	0	0	0	0
ISP Construction (Upfront)		280,835	7,513,588	4,346,185	2,636,094	1,598,872	941,439	13,830	13,830	13,830	13,830
Total Capital Expenditures		**$2,555,186**	**$27,214,742**	**$24,591,634**	**$21,637,256**	**$16,784,944**	**$2,015,118**	**$179,910**	**$179,910**	**$179,910**	**$179,910**
Unlevered Free Cash Flow		**($3,501,924)**	**($23,703,677)**	**($10,420,791)**	**($1,092,128)**	**$8,118,917**	**$25,978,386**	**$29,377,218**	**$30,246,626**	**$31,116,033**	**$31,985,441**
Interest Expense		(165,474)	(182,801)	(201,943)	(223,089)	(246,449)	(272,255)	(300,764)	(332,258)	(367,050)	(405,485)
Debt BoP		$10,000,000	$9,007,448	$8,032,223	$7,076,140	$6,141,203	$5,229,626	$4,343,855	$3,486,594	$2,660,826	$1,869,850
Debt Amort		(992,552)	(975,225)	(956,083)	(934,937)	(911,577)	(885,770)	(857,262)	(825,768)	(790,976)	(752,541)
Debt EoP	**$10,000,000**	**$9,007,448**	**$8,032,223**	**$7,076,140**	**$6,141,203**	**$5,229,626**	**$4,343,855**	**$3,486,594**	**$2,660,826**	**$1,869,850**	**$1,117,309**
Levered Cash Flows (Pre-Equity Funding)		($4,659,950)	($24,861,703)	($11,578,817)	($2,250,154)	$6,960,891	$24,820,360	$28,219,192	$29,088,600	$29,958,007	$30,827,415
Equity Infusion		0	0	973,924	2,250,154	0	0	0	0	0	0
Cash BoP		$40,126,546	$35,466,596	$10,604,893	$0	$0	$6,960,891	$31,781,251	$60,000,444	$89,089,043	$119,047,051
Cash Flows		(4,659,950)	(24,861,703)	(10,604,893)	0	6,960,891	24,820,360	28,219,192	29,088,600	29,958,007	30,827,415
Cash EoP	**$40,126,546**	**$35,466,596**	**$10,604,893**	**$0**	**$0**	**$6,960,891**	**$31,781,251**	**$60,000,444**	**$89,089,043**	**$119,047,051**	**$149,874,466**
Total Equity Invested	30,126,546	30,126,546	30,126,546	31,100,470	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624

		11	12	13	14	15	16	17	18	19	20	21
		12/31/2031	12/31/2032	12/31/2033	12/31/2034	12/31/2035	12/31/2036	12/31/2037	12/31/2038	12/31/2039	12/31/2040	12/31/2041
($ in USD)		2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Revenue												
Services Revenue		$37,674,330	$38,543,737	$39,413,145	$40,282,552	$41,151,960	$42,021,368	$42,890,775	$43,470,380	$43,470,380	$43,470,380	$32,602,785
Other Revenue		0	0	0	0	0	0	0	0	0	0	0
Total Revenue		**$37,674,330**	**$38,543,737**	**$39,413,145**	**$40,282,552**	**$41,151,960**	**$42,021,368**	**$42,890,775**	**$43,470,380**	**$43,470,380**	**$43,470,380**	**$32,602,785**
Operating Expenses												
General Operations (Ongoing)		3,195,755	3,195,755	3,195,755	3,195,755	3,195,755	3,195,755	3,195,755	3,195,755	3,195,755	3,187,729	1,883,237
ISP Operations (Ongoing)		1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,082,862
Total Expenses		**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,639,571**	**$4,631,545**	**$2,966,099**
EBITDA		**$33,034,759**	**$33,904,166**	**$34,773,574**	**$35,642,982**	**$36,512,389**	**$37,381,797**	**$38,251,204**	**$38,830,810**	**$38,830,810**	**$38,838,836**	**$29,636,686**
% margin		*87.7%*	*88.0%*	*88.2%*	*88.5%*	*88.7%*	*89.0%*	*89.2%*	*89.3%*	*89.3%*	*89.3%*	*90.9%*
Capital Expenditures												
Assessment (Upfront)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Engineering (Upfront)		166,080	166,080	166,080	166,080	166,080	166,080	166,080	166,080	166,080	166,080	124,560
Construction (Upfront)		146,235	438,704	438,704	438,704	337,623	135,461	135,461	135,461	135,461	135,461	0
ISP Construction (Upfront)		117,679	325,376	325,376	325,376	325,376	325,376	325,376	325,376	325,376	325,376	233,660
Total Capital Expenditures		**$429,994**	**$930,160**	**$930,160**	**$930,160**	**$829,080**	**$626,918**	**$626,918**	**$626,918**	**$626,918**	**$626,918**	**$358,220**
Unlevered Free Cash Flow		**$32,604,765**	**$32,974,006**	**$33,843,414**	**$34,712,821**	**$35,683,310**	**$36,754,879**	**$37,624,287**	**$38,203,892**	**$38,203,892**	**$38,211,918**	**$29,278,467**
Interest Expense		(447,944)	(494,850)	(546,667)	(603,911)	(667,148)	(737,007)	(814,181)	(899,437)	(993,619)	(1,097,664)	0
Debt BoP		$1,117,309	$407,227	($255,949)	($867,307)	($1,421,423)	($1,912,301)	($2,333,320)	($2,677,164)	($2,935,754)	($3,100,160)	($3,160,522)
Debt Amort		(710,082)	(663,176)	(611,359)	(554,115)	(490,878)	(421,019)	(343,845)	(258,589)	(164,407)	(60,362)	0
Debt EoP	**$10,000,000**	**$407,227**	**($255,949)**	**($867,307)**	**($1,421,423)**	**($1,912,301)**	**($2,333,320)**	**($2,677,164)**	**($2,935,754)**	**($3,100,160)**	**($3,160,522)**	**($3,160,522)**
Levered Cash Flows (Pre-Equity Funding)		$31,446,739	$31,815,980	$32,685,388	$33,554,795	$34,525,284	$35,596,853	$36,466,261	$37,045,866	$37,045,866	$37,053,892	$29,278,467
Equity Infusion		0	0	0	0	0	0	0	0	0	0	0
Cash BoP		$149,874,466	$181,321,205	$213,137,185	$245,822,573	$279,377,368	$313,902,652	$349,499,505	$385,965,766	$423,011,632	$460,057,497	$497,111,389
Cash Flows		31,446,739	31,815,980	32,685,388	33,554,795	34,525,284	35,596,853	36,466,261	37,045,866	37,045,866	37,053,892	29,278,467
Cash EoP	**$40,126,546**	**$181,321,205**	**$213,137,185**	**$245,822,573**	**$279,377,368**	**$313,902,652**	**$349,499,505**	**$385,965,766**	**$423,011,632**	**$460,057,497**	**$497,111,389**	**$526,389,856**
Total Equity Invested	30,126,546	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624	33,350,624

Last Mile / Fiber-to-the-Premise ("FTTP") Partner Network Full build out

Assumptions

- **Demographics:** York County, PA demographics per American Community Survey data[8]

Demographics	
Population	449,058
Median HH Income	$66,457
Median Age	41

- **Demand Points:** The below metrics were used for the extrapolation of the full County FTTP Partner financial model.

Demand Points[9] - Homes and Businesses	
Residential Demand Points	201,500
Business Demand Points	2,015
Total Demand Points	**203,515**
Estimated Take Rate[10]	**50%**

- **Right of Way Length of Network and Aerial vs. Underground:** Using the Preliminary Design and pole digitization extrapolated data, we've assumed 50% aerial and 50% underground build in the Right of Way ("ROW")[11] for the County's FTTP network. Aerial deployment typically is one of the most cost effective methods of deploying fiber to customers, because of the ability to leverage existing pole lines and avoiding additional costs of digging up roads or burying cables. An underground network means that fiber cables are buried underground. The cable needs to be buried deep in the ground to protect it from accidental damage – and the deeper we have to dig the more costly it is. Unforeseen obstacles such as tree roots can dramatically add to costs. If a buried direct cable is broken it is expensive to repair. Direct burying of fiber cables may be resistant to environmental factors (hurricanes, heat, rain, soil acidity, etc.), but are much more expensive than aerial fiber optic builds.[12]

[8] https://www.census.gov/quickfacts/yorkcountypennsylvania
[9] *Demand Points: Number of potential residential, commercial, and wireless connections.*
[10] *Take Rate: Connected demand points / total demand points of the network.*
[11] *Right of Way: Where fiber is placed; the legal right, established by usage or grant, to pass along a specific route.*
[12] "Key Factors when Choosing between buried and aerial deployments"

Right of Way Preliminary Design Results	
Aerial Length ROW	8,250,000
Underground Length ROW	8,250,000
Existing Aerial ROW	0
Existing Underground ROW	0

- **Additional Network Assumptions:**

Additional Network Assumptions	
Span Factor	100
Estimated Pole Count	82,500
Cabinets or Shelters	199
Engineering Duration (months)	84
Make Ready Duration (months)	60
Construction Duration (months)	84
Financial Duration (months)	240
Take Rate Duration (months)	96

  - Span factor: Average length between poles on site
  - Estimated pole count: Total utility poles based on pole digitization and auto design
  - Cabinets or shelters: Structure where electronics are held
  - Engineering Duration: Total time to complete full design and architecture
  - Make Ready Duration: Total time to prepare existing poles for fiber attachments (planning, measurements, permitting, making space on poles for new fiber)
  - Construction Duration: Total time to construct network
  - Financial Duration: Total time of financial cash flows
  - Take Rate Duration: Total time until assumed network achieves targeted take rate (connected demand points / total demand points of the network).

Expenses of the Last Mile/FTTP Partner Network per Phase

The network deployment is broken up into four major phases including Assessment, Engineering, Construction, and Operations as shown on the "Expenses" tab of the Financial Model.

5. Assessment

The total costs for the Assessment Phase are assumed to be $138,164 for the FTTP Partner to complete a preliminary design for the full County deployment.

6. Engineering

The total costs for the Engineering Phase are $19,558,896 and includes the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost shown below. These tasks will all be completed during months 1-84.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Engineering							
Director of Engineering	Hourly	173	84	1	84	$68.00	$988,176
Senior Network Designer	Hourly	173	84	1	84	55.00	799,260
Senior Network Designer	Hourly	173	84	1	84	55.00	799,260
Field Engineer and Permit Coordinator	Hourly	173	84	1	84	50.00	726,600
Core Network Engineering Consulting Services	Hourly	173	2	1	2	250.00	86,500
Pole Data Collection Field	Poles	82,500	84	1	84	38.00	3,135,000
Construction Package Creation	Feet	16,500,000	84	1	84	0.04	660,000
Permit Package Creation	Underground Length	8,250,000	84	1	84	0.75	6,187,500
Permit Fees	Each	8250	84	1	84	125.00	1,031,250
Building Inspection & Engineering	Business Demand Points	2,015	84	1	84	250.00	503,750
BOM & Splice Sheets	Feet	16,500,000	84	1	84	0.08	1,320,000
CEO or General Manager	Hourly	173	240	1	240	80.00	3,321,600
				$19,558,896			**Total Engineering**

- Engineering Staff
    - Local Engineering Project Manager
    - Local GIS Engineer
    - Field Designer and Permit Coordinator
- Construction Package Creation- This task includes two steps: 1) Create drawings for bid packages; 2) Create detailed construction drawings with the General Contractor that gets awarded the construction phase.
- Pole Data Field Collection- This task allows for field collection about aerial poles used for network deployment that cannot be captured remotely. Some tasks that fall within this category include: utility pole attachments and equipment heights, verify geolocation data and pole tag identification, and measuring pole distance from roads and confirming road condition.
- Permit Package Creation- This is to create permits including County, Rail-Road, State DOT as needed based on the routes we select.
- Biological and Cultural Surveys- Biological and cultural resource surveys are conducted during the route planning stage to identify potentially sensitive resources.
- Building Inspection & Engineering- This includes a review that confirms all features and connectivity (including splicing of the fibers) are accurate. The cables are properly sized and all other QC checkpoints are accurately completed. Routes for constructability would also be reviewed during this task.
- BOM & Splice Sheets- A Bill of Materials will be created that includes blended costs for materials, labor and any additional fees for the project including interconnectivity fees and operations and maintenance costs. This task is to create a Bill of Material and Splice Sheets to complete the overall construction packages for the General Contractor. Initial BOMs for the targeted end users for bid packages will be created and then more detailed BOMs will be created based on material vendors used and the General Contractor's procurement of materials.

7. Construction

The total costs for the Construction Phase are $294,952,242 (less material waste) and includes the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost shown below. The final pricing for this phase will be established during the Engineering Phase, and the Financial Model will be reflected accordingly.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Construction							
Make Ready Construction	Miles	1563	60	3	62	$12,500.00	$19,531,250
Optical Network Terminal	Demand Points	122109	24	2	25	75.00	9,158,175
Optical Network Terminal Replishments	Demand Points	122109	112	120	231	75.00	4,579,088
Distribution Cabinets	Cabinets	199	84	2	85	41,135.08	8,175,396
Cabinet Shipping	Cabinets	199	84	1	84	4,041.00	803,129
ONT Shipping	Cabinets	170	84	1	84	2,698.21	457,605
Distribution Splitters	Cabinets	199	84	2	85	28,633.00	5,690,669
Cabinet Electronics	Cabinets	199	84	2	85	23,946.50	4,759,250
Cabinet Electronics Replenishments	Cabinets	199	84	120	203	23,946.50	4,759,250
Cabinet Electronics Professional Services	Each	199	84	2	85	33,560.00	6,669,886
Underground Construction - Labor	Miles	1563	84	5	88	84,094.31	131,397,355
Underground Construction - Materials	Miles	1563	84	1	84	23,172.60	36,207,183
Aerial Construction - Labor	Miles	1563	84	5	88	20,705.17	32,351,827
Aerial Construction - Materials	Miles	1563	84	1	84	13,093.36	20,458,372
Material Waste	Miles	3125	84	1	84	1,963.30	6,135,305
As built updates & turnover	Feet	16,500,000	84	2	85	0.18	2,970,000
Director of Construction	Hourly	173	96	1	96	53.00	880,224
Project Coordinator	Hourly	173	93	4	96	45.00	724,005
Contingency	Months	1	84	1	84		5,914,159
				$294,952,242			**Total Construction**

- Make Ready Construction- This task is to complete the Make Ready Construction work on utility poles for the future placement of the strand of the aerial fiber placement.
- ONTs- The Optical Network Terminal (“ONT”) is the access endpoint that provides an optical termination at the subscriber premises, and provides subscriber interfaces (Ethernet, POTS, DS1, etc.).
    - ONT Electronics
    - ONT Replenishments
- OLTs- The Optical Line Terminal (“OLT”) is the access node that provides GPON network terminations.
    - OLT Cabinets and Construction- OLT cabinet is the physical building to put equipment in. These can come pre-fabricated or can be a new structure the community decides to build.
    - OLT Line Cards and Splitters
- Electronics Professional Services- Additional services that may be performed by an electronics provider.
- Shipping
    - Electronics Shipping- Cost of sending electronics from warehouse to Oldham County.
    - Cabinet Shipping- Cost of sending cabinets from warehouse to Oldham County.
- Underground Construction- Labor- Cost of construction crews to build the County’s fiber network during underground deployment.
- Underground Construction- Materials- Cost of materials including fiber cables, MSTs, drops, vaults, conduit.
- Aerial Construction- Labor- Cost of construction crews to build the County’s fiber network during aerial deployment.
- Aerial Construction- Materials- Cost of materials including fiber cables, MSTs, strands, lashing wires, splice closures.
- Material Waste- Unwanted or unusable materials
- Construction Personnel:
    - Director of Construction
    - Construction Coordinator
- Contingency- Built in costs in case of construction cost overruns.

8. Operations & Maintenance

The total costs for the Operations Phase during the construction period is $48,780,119, and the recurring monthly costs are estimated to be $833,345 once construction is complete and

will be covered entirely by revenue generated from the network. See below for the Tasks, Unit of Measure, Volume, Unit Cost, and Total Cost.

Task	Unit of Measure	Volume	Duration	Start Month	End Month	Unit Cost	Total Cost
Operations							
Employee Laptops and Desk Equipment	Each	9	2	1	2	$2,500.00	$22,500
Employee Software - Adobe, Office, etc.	Each	240	240	1	240	1,350.00	$324,000
Travel Expenses	Each	1	84	1	84	5,000.00	$420,000
Moving Expenses	Each	3	2	1	2	12,000.00	$36,000
Company Truck for Director of Construction	Months	40	40	1	40	2,200.00	$88,000
Vehicle Per Diem during Engineering and Construction	Months	80	40	1	40	500.00	$40,000
O&M Project Management	Months	239	239	2	240	5,400.00	1,290,600
Maintenance Incident Repair During Construction	Incidents	16	84	1	84	525.00	8,400
Maintenance Incident Repair Post Construction	Incidents	136	147	37	183	900.00	122,400
Calix Essential Support Entitlement	Each	239	239	2	240	5,995.00	119,400
Calix Training Subscription	Each	5	3	2	4	2,940.00	14,700
ONT Subsciber Annual Term License - up to 1000	Demand Points Connected	1000	N/A	N/A	N/A	4.99	0
ONT Subsciber Annual Term License - 1000 -2,499 subscriptions	Demand Points Connected	2499	N/A	N/A	N/A	3.30	4,253
ONT Subsciber Annual Term License - 2,500-4,999 subscriptions	Demand Points Connected	4999	N/A	N/A	N/A	2.59	8,202
ONT Subsciber Annual Term License - 5,000- 9,999 subscriptions	Demand Points Connected	9999	N/A	N/A	N/A	2.16	145,300
ONT Subsciber Annual Term License - 10,000 - 24,999 subscriptions	Demand Points Connected	24999	N/A	N/A	N/A	1.95	3,068,458
Router Subscription: 50-249 Customers	Demand Points Connected	249	N/A	N/A	N/A	10.50	0
Router Subscription: 250 - 999 Customers	Demand Points Connected	999	N/A	N/A	N/A	7.00	1,979
Router Subscription: 1000 - 4,999 Customers	Demand Points Connected	4999	N/A	N/A	N/A	5.25	8,636,303
Cabinet Electronics Warranty (every 5 years)	Each	199	177	55	231	274.80	18,205
Home Electronics Warranty (every 5 years)	Each	101758	177	55	231	40.32	1,367,621
Marketing Manager	Hourly	173	240	1	240	45.00	1,868,400
OSS/BSS Software - Setup - Development	Months	1	1	1	1	135,000.00	135,000
OSS/BSS Software - Recurring	Demand Points	101758	N/A	N/A	N/A	1.00	19,743,513
GIS Monthly Services	Months	84	24	1	24	8,000.00	672,000
Construction Management Software	Months	237	237	4	240	299.00	70,863
Fiber Management System - Recurring	Months	240	240	1	240	2,500.00	600,000
GIS and OSS/BSS Integration	Each	1	1	1	1	30,000.00	30,000
Pole Attachment Fees	Poles	82,500	237	4	240	12.00	19,552,500
Middle Mile Network Fee	Subscriptions	101758	N/A	N/A	N/A	5.00	103,296,652
Stripe ACH Fees - Recurring	Demand Points Connected	101758	N/A	N/A	N/A	0.50	4,935,878
Plaid Fees - Recurring	Demand Points Connected	101758	N/A	N/A	N/A	0.10	987,176
Plaid Fees - Non Recurring	Demand Points Connected	101758	N/A	N/A	N/A	1.50	76,318
Lawyer Fees - Non Recurring	Months	1	1	1	1	35,000.00	35,000
Lawyer Fees - Recurring	Months	239	239	2	240	5,500.00	1,314,500
Network Insurance	Months	239	239	2	240	12,500.00	2,987,500
Pole Repairs	Months	4125	204	37	240	250.00	1,031,250
							Total Operations

- Employee Laptops and Desk Equipment- Laptops and desk equipment for employees of the network.
- Employee Software- Adobe, Office, etc.- Computer software for network employees.
- Travel Expenses- Travel expenses to/from the market
- Moving Expenses- Relocation fees for employees of the network to move locally.
- Technical Maintenance and On-Call Recurring- Operations and maintenance for technical support
- Electronics Support-On-Call support from an electronics vendor to troubleshoot and repair any issues.
- Electronics Training-Training for local teams on fiber electronics.
- Electronics Software Subscriptions and Warranties-Software subscription to enhance operations and maintenance of fiber electronics. Additional warranties to pay for any repairs needed.
- Office Administrator-Personnel hired to assist with administrative tasks related to construction and launch of operations and maintenance for the network.
- Neighborhood Coordinator- Person overseeing local grassroots marketing, coordinating Fiber MVPs/Champions, fiberhood deployment, and assisting with community relations during construction.
- Marketing Administrator- Person overseeing marketing of the network. Responsibilities include: short and long term marketing and branding strategies, advertising campaigns, and local engagement.
- Financial Manager- Cost of personnel for managing the finances of the network. The financial manager is responsible for accounting, financial statements, and business reporting.

- OSS/BSS Software - Setup - Development- Cost to set up the operations and billing software system which facilitates customer orders, billing, workflow, analytics, and other network needs.
- OSS/BSS Software - Recurring- Ongoing cost for operations and billing software system which facilitates customer orders, billing, workflow, analytics, and other network needs.
- GIS Monthly Services- GIS mapping and database critical for future technology including smart city innovations, autonomous vehicles, 5G, etc.
- Fiber Management System- Fiber Management system such as VETRO FiberMap used to keep track of the design and database of fiber inventory.
- Middle Mile Connection- Middle Mile fiber connectivity to light the last mile network. In this case, we would connect this to the County's backbone network. If the City owns the backbone network, they would be collecting these fees.

ISP expenses

In order to provide internet to residents and small businesses, the FTTP Partner will need to implement certain items and we've accounted for these in the ISP-Construction and ISP-Operations sections.

ISP - Construction							
Electronics - WiFi Router	Subscriptions	101758	N/A	N/A	N/A	$149.25	$15,187,307
Electronics - WiFi Router Replenishment	Subscriptions	101758	123	120	240	149.25	11,390,480
Aerial Full Installation	Subscriptions	50879	N/A	N/A	N/A	365.50	18,596,183
Underground Full Installation	Subscriptions	50879	N/A	N/A	N/A	475.50	24,192,846
Aerial Full Installation - churn portion	Subscriptions	N/A	N/A	N/A	N/A	365.50	401,696
Underground Full Installation - churn portion	Subscriptions	N/A	N/A	N/A	N/A	475.50	522,590
Inside Plant Materials	Subscriptions	101758	N/A	N/A	N/A	30.00	3,052,725
ISP Materials Warehouse Manager	Hourly	173	2	3	4	37.50	12,975
Router and Installation - 1st Datacenter	NOC Locations	1	1	3	3	250,000.00	250,000
Router and Installation - 2nd Datacenter	NOC Locations	1	1	8	8	250,000.00	250,000
1st Data Center Electronics	Each	1	1	3	3	24,347.00	24,347
2nd Data Center Electronics	Each	1	1	8	8	24,347.00	24,347
				$73,905,496			**Total ISP - Construction**

ISP - Operations							
Backhaul and transit services - (20G Circuit)	Months	12	12	3	14	10,800.00	$129,600
Backhaul and transit services - (40G Circuit)	Months	12	12	15	26	19,440.00	233,280
Backhaul and transit services - (100G Circuit)	Months	214	214	27	240	29,160.00	6,240,240
Backhaul and transit services - 10G or 20G (2nd/backup)	Months	233	233	8	240	10,800.00	2,516,400
Backhaul and transit services - 1st Colocation	Months	238	238	3	240	600.00	142,800
Backhaul and transit services - 2nd Colocation	Months	233	233	8	240	850.00	198,050
Network Operations Center - Phase 1	Months	5	5	4	8	1,698.00	8,490
Network Operations Center - Phase 2	Months	7	7	9	15	2,523.00	17,661
Network Operations Center - Phase 3	Months	5	5	16	20	3,513.00	17,565
Network Operations Center - Phase 4	Months	5	5	21	25	4,933.00	24,665
Network Operations Center - Phase 5	Months	8	8	22	29	6,583.00	52,664
Network Operations Center - Phase 6	Months	211	211	30	240	7,738.00	1,632,718
Marketing Startup Budget	Months	9	9	1	9	23,774.44	213,970
Local Marketing Consultant	Months	240	240	1	240	2,500.00	600,000
Digital Advertising	Months	240	240	1	240	1,000.00	240,000
Marketing Cloud Services	Each	1	1	1	1	127,865.00	127,865
Sales Associate	Hourly	173	238	3	240	25.00	1,029,350
Sales Associate	Hourly	173	238	3	240	25.00	1,029,350
Sales Associate	Hourly	173	233	8	240	25.00	1,007,725
Sales Associate	Hourly	173	233	8	240	25.00	1,007,725
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Customer Services Representative	Hourly	173	238	3	240	47.50	1,955,765
Demonstration Center Setup	Months	2	2	1	2	100,000.00	200,000
Demonstration Center and Local Office Recurring	Months	238	238	3	240	5,000.00	1,190,000
Insurance Setup	Months	1	2	1	2	30,000.00	30,000
Insurance Premiums	Months	239	239	2	240	12,500.00	2,987,500
				$28,700,678			**Total ISP - Operations**

Projections

In the FTTP Partner financial model, we show on the "Model" tab cash flow projections for the 20-year period of the project. A screenshot of the tab is shown below which captures the

revenues, expenses, EBITDA, capital expenditures, debt financing, and cash flows after financing costs. This model currently assumes majority equity financing and partial debt financing after the project reaches a permanent period.

		1	2	3	4	5	6	7	8	9	10
		12/31/2021	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026	12/31/2027	12/31/2028	12/31/2029	12/31/2030
($ in USD)		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Revenue											
Services Revenue		$0	$15,361,684	$41,205,883	$59,499,124	$74,842,380	$87,806,980	$98,855,838	$108,363,460	$116,632,407	$123,906,801
Other Revenue		0	0	0	0	0	0	0	0	0	0
Total Revenue		**$0**	**$15,361,684**	**$41,205,883**	**$59,499,124**	**$74,842,380**	**$87,806,980**	**$98,855,838**	**$108,363,460**	**$116,632,407**	**$123,906,801**
Operating Expenses											
General Operations (Ongoing)		459,904	3,146,654	5,071,645	6,154,516	7,198,293	8,067,370	8,715,310	9,186,332	9,519,181	9,814,151
ISP Operations (Ongoing)		522,608	1,226,878	1,325,768	1,441,506	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816	1,443,816
Total Expenses		**$982,512**	**$4,373,531**	**$6,397,413**	**$7,596,022**	**$8,642,109**	**$9,511,186**	**$10,159,126**	**$10,630,148**	**$10,962,997**	**$11,257,967**
EBITDA		**($982,512)**	**$10,988,153**	**$34,808,470**	**$51,903,102**	**$66,200,271**	**$78,295,794**	**$88,696,712**	**$97,733,311**	**$105,669,410**	**$112,648,834**
% margin			*71.5%*	*84.5%*	*87.2%*	*88.5%*	*89.2%*	*89.7%*	*90.2%*	*90.6%*	*90.9%*
Capital Expenditures											
Assessment (Upfront)		$138,164	$0	$0	$0	$0	$0	$0	$0	$0	$0
Engineering (Upfront)		704,834	2,473,337	2,473,337	2,473,337	2,473,337	2,473,337	2,473,337	1,896,522	166,080	166,080
Construction (Upfront)		4,288,324	44,166,553	45,352,767	41,536,860	41,536,860	41,211,340	37,630,610	34,458,495	2,101,981	0
ISP Construction (Upfront)		280,835	17,985,593	11,038,425	8,596,734	6,695,143	5,214,183	4,060,810	3,162,562	2,463,006	1,918,191
Total Capital Expenditures		**$5,412,156**	**$64,625,483**	**$58,864,528**	**$52,606,931**	**$50,705,340**	**$48,898,859**	**$44,164,757**	**$39,517,580**	**$4,731,067**	**$2,084,271**
Unlevered Free Cash Flow		**($6,394,669)**	**($53,637,330)**	**($24,056,058)**	**($703,829)**	**$15,494,930**	**$29,396,935**	**$44,531,955**	**$58,215,732**	**$100,938,344**	**$110,564,563**
Interest Expense		(165,474)	(182,801)	(201,943)	(223,089)	(246,449)	(272,255)	(300,764)	(332,258)	(367,050)	(405,485)
Debt BoP		$10,000,000	$9,007,448	$8,032,223	$7,076,140	$6,141,203	$5,229,626	$4,343,855	$3,486,594	$2,660,826	$1,869,850
Debt Amort		(992,552)	(975,225)	(956,083)	(934,937)	(911,577)	(885,770)	(857,262)	(825,768)	(790,976)	(752,541)
Debt EoP	**$10,000,000**	**$9,007,448**	**$8,032,223**	**$7,076,140**	**$6,141,203**	**$5,229,626**	**$4,343,855**	**$3,486,594**	**$2,660,826**	**$1,869,850**	**$1,117,309**
Levered Cash Flows (Pre-Equity Funding)		($7,552,695)	($54,795,356)	($25,214,084)	($1,861,855)	$14,336,905	$28,238,909	$43,373,929	$57,057,706	$99,780,318	$109,406,537
Equity Infusion		0	0	16,857,153	1,861,855	0	0	0	0	0	0
Cash BoP		$70,704,982	$63,152,287	$8,356,931	$0	$0	$14,336,905	$42,575,814	$85,949,743	$143,007,449	$242,787,766
Cash Flows		(7,552,695)	(54,795,356)	(8,356,931)	0	14,336,905	28,238,909	43,373,929	57,057,706	99,780,318	109,406,537
Cash EoP	**$70,704,982**	**$63,152,287**	**$8,356,931**	**$0**	**$0**	**$14,336,905**	**$42,575,814**	**$85,949,743**	**$143,007,449**	**$242,787,766**	**$352,194,303**
Total Equity Invested	60,704,982	60,704,982	60,704,982	77,562,135	79,423,990	79,423,990	79,423,990	79,423,990	79,423,990	79,423,990	79,423,990
Returns											
Enterprise Value @ 10.0x Exit Multiple	10.0x	**($9,825,125)**	**$109,881,532**	**$348,084,701**	**$519,031,019**	**$662,002,708**	**$782,957,941**	**$886,967,120**	**$977,333,111**	**$1,056,694,101**	**$1,126,488,336**
Debt		(9,007,448)	(8,032,223)	(7,076,140)	(6,141,203)	(5,229,626)	(4,343,855)	(3,486,594)	(2,660,826)	(1,869,850)	(1,117,309)
Cash		63,152,287	8,356,931	0	0	14,336,905	42,575,814	85,949,743	143,007,449	242,787,766	352,194,303
Equity Value @ 10.0x Exit Multiple		**$44,319,714**	**$110,206,240**	**$341,008,561**	**$512,889,817**	**$671,109,987**	**$821,189,899**	**$969,430,270**	**$1,117,679,734**	**$1,297,612,018**	**$1,477,565,331**
Equity Returns											
MoIC Returns		***0.7x***	***1.8x***	***4.4x***	***6.5x***	***8.4x***	***10.3x***	***12.2x***	***14.1x***	***16.3x***	***18.6x***

Smart City Planning

Enhanced connectivity through high-speed internet brings with it many opportunities for York to build a better future. By leveraging connectivity the County can meet existing goals as well as build out future strategies. Smart City applications come in various forms and can contribute to Government efficiency, economic development, sustainability, health and wellness, public safety, enhanced mobility and overall quality of life for residents.

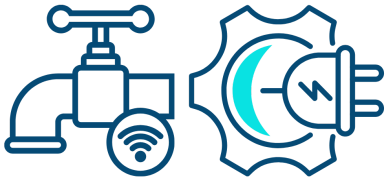
The County can introduce energy saving smart lighting solutions that are activated only when pedestrians or vehicles are near. Smart lighting solutions also communicate data allowing for predictive energy usage as well as communicate when LED bulbs need replacement.

Various sensors can also be installed and operated such as Air Quality Sensors to detect elevated levels of harmful particles & chemicals and alert the County, Cities and Boroughs. Acoustic Gunshot Detection Sensors are also very effective in quickly locating where a weapon is fired and relay information to authorities. Acoustic Gunshot Sensors can also communicate with and activate other sensors such as cameras to help identify potential criminal activity. The City of York's proposed security camera network may also benefit from broadband connections.

Smart Utilities

Implementing smart utilities means you know precisely where your utility assets are located, their age and if they are in proper working order. By implementing a high speed fiber network you can operate many low bandwidth smart assets to develop a true asset management system where tracking equipment lifecycles and planning & budgeting become streamlined.

York County can greatly benefit by presenting these options to local utilities who could realize substantial savings by streamlining utility metering through Advanced Metering Infrastructure (AMI). AMI systems are a network of integrated smart meters that enable two way communication between utilities and customers. In addition to remote metering and billing capabilities AMI systems can also be used for engineering, dispatch, customer service, operations and more.



Local utilities can leverage new connectivity and supervisory control and data acquisition (SCADA) systems can be implemented that act as automation control systems allowing for the monitoring of utilities and a network of intelligent sensors and devices that interface with the

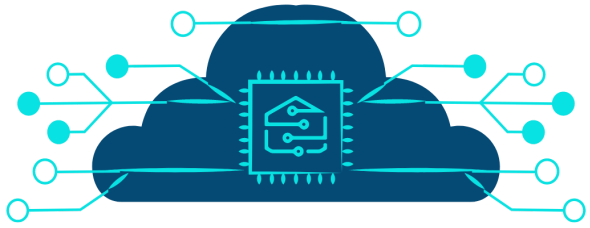
utility. SCADA systems are very good at helping you control and streamline complex processes saving time and money. SCADA can be very effective when operating a decentralized microgrid where supply can be more effectively managed.

Reduced Homework Gap (K-16)

70% of teachers provide homework online and the homework gap continues to grow as students lack access to high speed internet. Building out the proposed network is a major stride in closing the digital divide and the homework gap along with it. As pointed out by the Conney Center, "access is no longer just a yes/no question. The quality of families' Internet connections, and the kinds and capabilities of devices they can access, have considerable consequences for parents and children alike.". Constructing a solid middle mile network and finding the right partner for a last mile network will give York the control to meet these access needs for its residents.

Public Safety (Resiliency)

Public safety is paramount for any city and York will be in a good position to support public safety efforts through enhanced connectivity. Many of the Anchor institutions chosen by York as essential facilities to connect to your middle mile will be the first to benefit from your fiber network. Having both fast internet and built in network redundancy allows for emergency responders to stay connected and ensure facilities are up and running. In the future intelligent infrastructure can also coordinate automatically with emergency responders needs to cut minutes off of response time



Another aspect of public safety is disaster events. Tornados and other natural events are continually threatening both infrastructure and people in their path. Solid and reliable backbone fiber allows for early warning systems to be put into place that will withstand disaster events and prevent both damage to property and threats to human life.

Public Parks and Rail Trail WiFi

Connecting public parks and trails with WiFi is a great way to incentivize residents to get out and enjoy the community. Having reliable internet access in public parks can also

dramatically increase safety along trails if there is an incident that requires emergency services as they can confidently contact authorities through WiFi calling. Having this access also lets park goers have quick access to weather and emergency updates via their smartphones. Another way public parks and trails connected to WiFi can benefit the County is by building a maintenance application for park staff that can assign and update crews on necessary tasks and pinpoint incidents, this brings operational efficiencies and will save money. York can also leverage connectivity along the Heritage Rail Trail by installing digital signage where the trail crosses major intersections and install WiFi operated dynamic digital signage displaying local events, hotspots, weather updates and more. This will encourage trail goers to visit local attractions and stimulate economic activity.

Downtown Revival (Business and Commerce)

Connecting York's downtown and mainstreets with high speed internet will both incentivise new businesses and also increase foot traffic. Having access to symmetrical high speed internet will attract fresh businesses that require high speeds to operate and will provide high paying job growth. Strong networks that will allow for restaurants, bars and coffee shops to offer patrons internet access encourages both frequency and duration of customer visits. There are also opportunities to build tourism apps that can be easily accessed and will educate residents and tourists about the rich history and modern attractions York has to offer.

Business Innovation (E-Commerce)

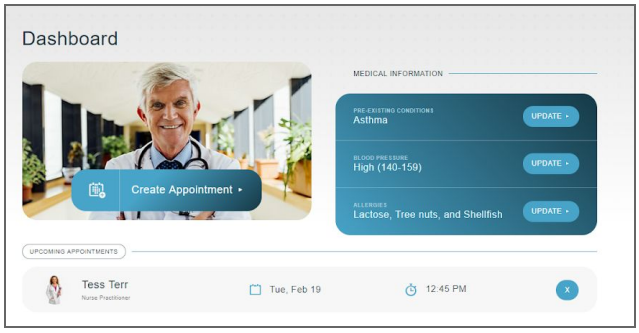
Having access to high speed internet will not just allow residents to shop online and engage in E-Commerce but will also allow businesses to expand their operations online. Having a robust underlying high-speed network connected to York businesses will allow them to implement reliable e-commerce which will allow them to thrive in this digital world. E-commerce has been growing for many years and the COVID-19 pandemic has accelerated this trend even further. With business expanding their potential customer base through the world wide web, York businesses will flourish.

E-Government

E-Government is the use of technological communications devices and the internet to provide public services to residents of the County. Although York is undoubtedly already engaging in some E-Governance, having a ultra fast high-speed network will allow for more consistent and expanded services. E-Government allows for reliable direct digital communications between the County, City, Borough, etc. and its residents. Not only is accessing Government portals online much more convenient for residents but also allows for

quicker communications, reduces congestion of government facilities and also cost of services. York will soon be in a position to deploy innovative delivery systems which can be taken advantage of by residents.

Telehealth



York can bridge the digital divide by making services available like telehealth on their new broadband network. By working with telehealth providers such as Docity, which partners with local hospital systems. Docity brings the clinic to the couch and the exam room to the living room by bundling livestreaming healthcare access to the home through on-bill partnerships with ISPs across the country. Their service includes a digital otoscope to allow customers to livestream the inside of their or their family member's ear, nose or throat to the doctor without leaving home. Telehealth through Docity's model isn't your typical tel-a-doc platform, it will allow people to basically have a full physical online. Lit is now seeing the powerful connection between the internet and telehealth like never before. We always thought it was very important to bring that service, on day one, onto last mile fiber networks and the COVID-19 landscape has only accelerated the need.

York can work to closer tie broadband with telehealth initiatives in order to close the digital and health gaps. We also believe that partnerships between York, telehealth companies, and healthcare institutions are critical during the development of your fast, reliable broadband network to ensure connectivity and equity.

Workforce Development

Affordable and accessible internet access allows for residents to expand their knowledge and skills in this increasingly digital world. Online training services have grown in recent years and are being highlighted by the recent COVID-19 pandemic because many have lost their jobs and need to train for new skills as well as the desire to limit person to person contact to contain the spread. Having a reliable high speed internet connection either in their home or through a local community center, residents will have the ability to sharpen their skills and expand into new fields which will contribute to York's economy.

Major Industries

If you build it they will come! There is a major economic development opportunity for York to attract new high-tech industries to the community. Having a high-speed symmetrical network

will make York very competitive when putting in national bids to attract companies relocating or building a new facility. Industries such as Advanced Manufacturing & Robotics, Automobile Manufacturing and Energy will undoubtedly find their home in the newly connected York of the future.

Bringing high speed internet to York is the first step to delivering smart city applications. York should not wait to start assessing community priorities when it comes to smart city applications. Lit Communities recommends bringing together community stakeholders and diving into the County's Comprehensive plan to surface community needs.

Risks/Mitigants

Political Risks

Competes with Private Sector

- There is potential to partner with the private sector
- Since the network is aimed at serving underserved residents for educational purposes it is not viewed as much of a threat.
- Community networks have often accelerated local economies where they are built.
- Municipal networks promote competition and create local jobs.
- Public investment is intended to entice private investment where it has not yet occurred due to market conditions

Aversion to Increasing Tax Burden

- There are many options to consider when building out and funding either a middle mile or last mile network and a strategic blend of different funding sources can greatly reduce the County's need to consider a tax rate increase.
- Both networks have the potential to generate revenue for the owner and community
- There are increasing number of public grant programs to help underwrite the cost of broadband expansion

Construction Risks

Cost Overruns

- All networks go through preliminary design, as well as detailed design and engineering studies with expert oversight.
- All contractors must have operating history and are extensively vetted.

- Contractors will have performance requirements and penalty payments will be assessed for projects behind schedule.
- Letter of credit required from contractor for non-performance.
- Insurance required for each project and liquidated damages tied to performance.
- Not to exceed language is incorporated into the current construction contract.

Operational Risks

Network operations fail to deliver excellent customer experience

- Lit will make recommendations to the County for partners who we have worked with and who we know to have extensive municipal experience.

Operations and data capacity

- Lit will coordinate network planning, cost estimates, engineering and design, hardware, fiber optics, wireless devices, construction management and planning and technical NOC services.

Revenue Risk

Building a network with no subscribers

- Build only where there is proven demand- it is expected to be strong because County residents are either unconnected, dissatisfied with incumbents or are without access to broadband speeds.

Technology Risks

5G will make fiber obsolete

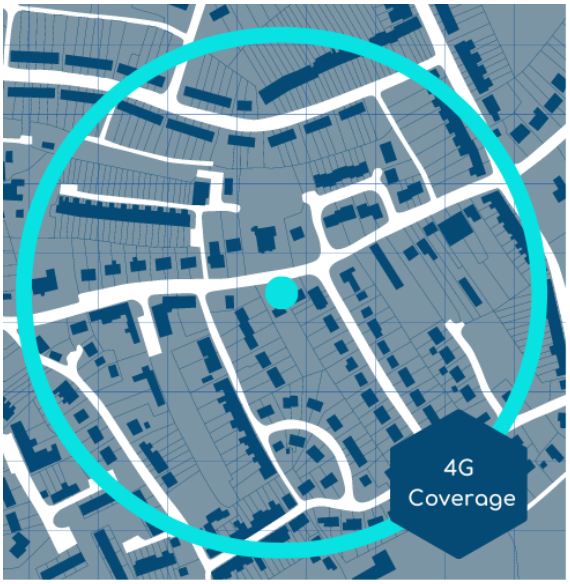
- Fiber is critical to effective 5G rollout.
- 5G providers benefit from existing fiber networks.
- Access will be leased to 5G providers.
- 5G only travels roughly 500’ and will mainly be used for smart city technologies that require low latency (autonomous vehicles).

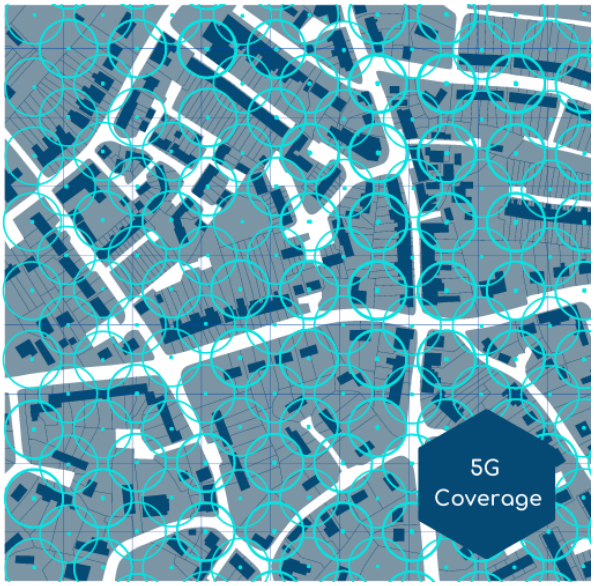
Fiber will be obsolete in X years

- Hard to beat the speed of light. We believe fiber infrastructure is a long-term investment.
- Equipment on the network includes planned obsolescence: periodic upgrades are budgeted into operations.

Network Future Proofing

While the initial cost to build a fiber network may appear high, if properly designed with capacity to support not just current potential subscribers but also future development and future smart city use cases, the useful life of the fiber assets themselves and their ability to meet the needs of the community will last many decades. The cables themselves are passive strands of pure glass which merely carry light back and forth, therefore as new optics and electronics that enable higher speeds are developed and become available, upgrading to





them is a simple matter of swapping out the equipment in the head end.

Fiber optic networks are the underpinning of all connectivity dependent technology, including wireless mobile networks. All cell towers have what is called a fiber optic backhaul connection, to carry data received by the antennas between mobile devices and data centers/carrier hotels/points of presence. Due to the spectrums of frequency that current wireless technology uses, one 4G cellular antenna site can cover an area of roughly ten square miles. The next generation of wireless technology however, known as 5G, utilizes a different spectrum of frequency, which allows for massive amounts of data to be transmitted, but can only travel short distances. A 5G antenna site can therefore only cover an area of roughly 500 square feet, but must still be backhauled by a fiber cable. This means that the successful deployment of 5G mobile networks will go hand in hand with significant investments in fiber for backhaul.

Next Steps and Scenario Recommendations

Below is a distillation of next steps and recommendations that are a direct result of the Countywide Community Assessment and the culmination of this business plan.

Wired Recommendations

- Lit and Katapult recommend that the County proactively start planning for a submission to seek funding from the potential release of another CARES stimulus package. If another round of CARES funds becomes available the County should be ready to request funding to build off of what was accomplished on the Heritage Rail Trail.
- Lit and Katapult recommend that the County put together a committee of community stakeholders from both the public and private sector to assess the findings of this report and take action. This committee should consist of various industries prominent across the County as well as representation from various towns and boroughs affected by the potential expansion of what was started along the Heritage Rail Trail.
- Lit and Katapult recommend that the County focus on getting fiber infrastructure back to the main data centers in the City of York while also building diversity and redundancy into the existing network path constructed during the Rail Trail Project. Although the network has a very low probability of losing connection since it is buried underground, it is an industry best practice to ensure maximum uptime. Network Redundancy is having at least two independent means of internet connection and Network Diversity is having two independent internet connections routed between the same two locations without shared points in common.
- Through our strategy discussions and based on continuing the foundation already established in the pilot project, it is recommended that leadership focus on the Southern part of the County for the next phase of the project. It is advised that the County should focus on Rings 6 or 5 first because of the incorporation of the existing network built during the Pilot Project. Focusing on the Southern portion of the County also makes the project more manageable from a scale and cost perspective. The model will then have the ability and lessons learned to complete full countywide connectivity.
- Lit and Katapult recommend that the County finalize their business model for the Middle Mile network and determine if you would like to operate as a lit service or a dark fiber model.
    - Lit Service model- In this model the County will offer Lit internet services to anchor institutions and bandwidth (backhaul) services to Internet Service Providers and Wireless Carriers for better end user (residential and business) connectivity. This model offers the most amount of network control for the County without competing directly with private industry but instead partnering with them. This model is also the most conducive to building out an entire Middle Mile network to service the entire community. In the Lit service model the County will still be able

to lease dark fiber to other providers as well as offer Lit services to anchor institutions. Any network management services provided by the County can be done with minimal staff and can easily be outsourced to a 3rd party.

    - Dark Fiber model- In this model the County would lease the fiber to an existing Internet Service Provider (ISP) who will manage all the equipment and offer network security and maintenance for the network. This will result in less control over the network for the County. In this model we recommend looking for network "gaps" within the community where current providers of middle mile services do not have any infrastructure and fill in those gaps to ensure the network is desirable for lease. These gaps can be identified by working with local backhaul providers to discover areas without coverage.

- Lit and Katapult recommend the County pursue a structured relationship with a private partner selected to build a "10 year Smart City Plan" that is weaved into future comprehensive planning. This plan should consist of a roll out of technologies that can help the County and residents. There are immediate items that can be implemented that will help with the current COVID-19 situation in addition to road maps for longer smart applications including autonomous vehicles. The partner should have experience implementing Smart City applications and building the vertical and wireless infrastructure to complement the fiber to the antenna network.
- Lit and Katapult recommend the County conduct a web based demand aggregation survey of residents to get real feedback from potential customers. This survey will help determine priority of build and price points for potential offerings on the network. The information is also helpful when applying for grants as well as seeking outside investment. The initial area to start this should involve the ~50K demand points focused on in the first FTTP Partner modeling.
- The County should take full advantage of other broadband projects, community champions and potential partners to make the network a success and ensure consistency.
    - York College - York College is right off of the Heritage rail trail and would be a prime early customer of the network. The College currently has no contract with any ISP as they have expired and plans on making a decision for a new provider early in 2021.
    - Red Lion Area School District - Red Lion has technically minded leadership and used their own operational funds to build out some wireless antennas to serve underserved residents. Although they are in the early stages of an agreement through E-Rate to access middle mile fiber, Red Lion leadership expressed an interest in utilizing County built middle mile in five years when current contract ends. York County can target the build in this area to coincide with the contract.

- Southeastern School District - The School district has expressed interest in being involved in bringing better connectivity and is also located in the area the County will be targeting for the next phase of the project.

Wireless Recommendations

Wireless Scenarios

- Scenario #1 - The County can connect wireless CBRS equipment to towers along the Rail Trail and offer service to residents, businesses and schools within range from towers. This option requires the County to become a Wireless Internet Service Provider (WISP). There are costs associated with establishing a WISP and requires covenants with customers.
- Scenario #2 - The County can connect wireless CBRS equipment to towers along the Rail Trail and lease equipment to an existing WISP to handle service. In this model the County would connect to towers and purchase electronics and lease the use out to an existing WISP. There is risk in the model in that leasing wireless equipment is not as common as leasing fiber. Most WISPs prefer to build a solution from the ground up.
- Scenario #3 - The County could stick with the mobile wireless units already purchased to have temporary connectivity that meets all CARES requirements and focus more on building out fiber. While doing this, the County can still attract an existing WISP to connect to the network. In this model the County also has options to work with existing providers and set up WiFi equipment along the trail to enhance trail experience with WiFi availability and digital signage.

Wireless Expansion Considerations (If exploring Scenarios 1 or 2 above)

As this project develops and the network expands into other areas of the County, there may be wireless needs and strategies that develop and this section is meant to outline best practices that should be taken into consideration during the process. With any large project, the time and thought expended in the preliminary stages of the execution of a Wireless Access Network will reap benefits later in the process. A Wireless Access Network can come in many different shapes and sizes, and what works perfectly in one location may not even get off of the drawing board in a different location.

The following list is a high-level overview of the steps and processes that should be considered while building out a Wireless Access Network or reviewing such a proposal.

- Define the Area Of Interest
- Define the need in this Area Of Interest (AOI)
- Understand the ground topography of the AOI

- Discovery and quantifying of wired network assets
- Define frequency of operation and technology used
- Analyze placement of towers, antennas (nodes), and all network equipment
- Propagation modeling showing predictive coverage in the AOI
- Design backhaul network - link budgets for fiber transport or microwave point to point
- Develop IP network architecture

Define the Area Of Interest

What area is this wireless network intended to cover, a single residential home, an apartment complex, a college campus, a municipal mifi deployment, or a rural network coverage across a county? The answer to this question will play a big role in the decision of what technology and network architecture is used. For example; Mesh technology might work well in a campus or dense residential area where the users are within hundreds of feet of each other, but in a rural area with miles between users, Mesh would be a liability.

Define the Need

What are the goals of this wireless network? Will the users be looking at emails and light web browsing or will there be a lot of streaming media content and on-line meetings? Will the access be for mobile devices or multiple devices behind a residential WiFi router? Will the average user spend all day online, or will the network idle until 8pm when everyone streams movies? Discovering the need entails not only what the average user will consume bandwidth-wise, but what is the density of users in the AOI. Maps showing where every user is located will help to show the density of users and this information will be invaluable in designing coverage and capacity. More network assets will be necessary in the dense areas of the AOI.

Ground Topography

The local environment will impact the design of the wireless network. Are there lots of hills or is the AOI flat? Is this an area of pastures and fields or tall forests? Most RF propagation modeling software will include and handle typical clutter (vegetation, trees and other natural and man-made structures that can impede radio waves), but a good survey of the AOI is indispensable. The results of the survey will help network planners determine the optimal placement of network equipment to avoid obstacles, prevent potential wireless interference and compensate for local climate conditions.

Discovery of Wired Network Assets

Knowledge of any potential wired network assets will play into the overall buildout of the network. Are there any copper or fiber assets that can be used as backhaul? If there are no wired network assets, then all backhaul will need to be accomplished wirelessly, which is not a severe issue, but does add an additional layer of complexity to the whole design.

Define frequency of operation and technology used

The data collected from the previous studies and deliberations will direct the choices made here. While unlicensed 5GHz Point-to-Multipoint equipment might be a solid choice for a rural WISP, it would not be a good choice in an urban or densely populated suburban area where the interference from residential WiFi routers would handicap even the best RF design. 900MHz equipment, also, is a good choice for lightly populated areas but does not have sufficient bandwidth to meet the needs of a large populace.

CBRS is a “lightly” licensed spectrum between 3550~3700 MHz which offers high throughput with moderate range. It is regulated for commercial deployment as Part 96 Rules. Although its primary use will be for LTE, the band will include other non-LTE equipment that is CBRS/Part 96 compliant. CBRS devices must be installed by a Certified Professional Installer (CPI) and registered with a Spectrum Access System (SAS), which controls spectrum sharing and limits interference. The Spectrum Access System (SAS) is a cloud-based service that manages the wireless communications of devices transmitting in the CBRS band, in order to prevent harmful interference to higher priority users. Currently, the amount of bandwidth available to the general public is good, but will decrease as more users jump on the CBRS bandwagon. The rules and regulations of CBRS are not onerous, but add another level of complexity that the operator needs to keep in mind.

MIMO is a wireless technology that increases the data capacity of a RF radio by using multiple specially designed transmitting and receiving antennas. MIMO is short for Multiple-Input Multiple-Output. In a MIMO application, the same data is transmitted through multiple antennas over the same path in the same bandwidth. Because of the multiple data streams each signal reaches the receiving antenna through a different path, resulting in more reliable data. The receiver is designed to take into account the slight time difference between receptions of each stream as they travel through different paths. The data rate also increases by a factor determined by the number of transmit and receive antennas. Another advantage of the MIMO system is that it provides better signal strength without clear line-of-site as the multiple antennas utilize the bounced and reflected RF transmissions.

Analyze Placement of Towers, Antennas, and Network Equipment

The location and distribution of the end users is a very important aspect of the design of a well operating wireless network. For best use of network resources, the ideal tower location

would be in the center of the end users, but this is not always possible. Using rooftops is often a solution to a lack of tower availability. Also, when the location of the hub equipment is considered, nearby network assets such as fiber play into the decision making process.

Even after the best hub, or tower, location is chosen, the layout of the hub antennas is crucial. Each antenna will cover a sector and connect each end user to the radio network. How many CPE (end user equipment) can simultaneously access the radio is another criteria in the design process. The sectors need to be designed to have sufficient capacity (bandwidth) for all the CPE that would be covered in the RF signal transmitted out of that sector antenna.

An important issue that is related to sector coverage and capacity is frequency reuse. Unless the network is small enough to use allotted frequencies only once, the frequencies will have to be reused. Reusing frequencies can lead to high levels of interference unless the RF design takes into consideration the location, direction and power output of all of the antennae in the network.

Propagation Modeling

The process of properly designing a wireless network is made less of a herculean task when using a good RF design tool. The design tool will produce a map, sometimes called a “heat map”, of the area showing the predictive coverage of each sector antenna. The map will also show areas that might be blocked by obstructions. The colors typically show the signal strength expected, among other key performance indicators. The modeling will take several iterations to produce a design that meets design criteria.

Design Backhaul Network

Once the Radio Access Network is designed, the backhaul needs to be addressed. The Backhaul Network can be likened to primary streets and highways, while the Radio Access Network is the feeder and neighborhood streets. The Backhaul Network feeds the data streams from the hub or tower sites to the Internet point of presence. Local network assets like available fiber will be necessary, or wireless (microwave) backhaul can be used. Wireless backhaul can be done using unlicensed frequencies or licensed; each with their own pros and cons. There are many configurations of backhaul networks, but one important consideration is redundancy or backup. A “ring” of backhaul paths will offer redundant paths for the data streams. Single point to micropoint paths are to be avoided unless the paths are done using redundant microwave radios.

Develop IP Network Architecture

Now that we have all of these communication electronics, we need to make sure that all can talk together. The criteria for a fixed wireless network is different from a mobility network, where CPE might move from one sector antenna to another, or even to a different tower all together.

In addition to the different IP schemes, another consideration for the IP architecture is that the CBRS networks need to keep an open link from the SAS (Spectrum Access System) through the EPC (Evolved Packet Core) to the CPE.

Appendices

Broadband-Friendly Public Policies

Lit Communities ("Lit") recommends implementing broadband-friendly public policies and ordinances to reduce the capital costs of the institutional fiber broadband network buildout and to promote the buildout of privately owned and operated fiber networks, which ideally would encourage competition between existing ISPs and promote fiber broadband infrastructure deployment, thereby helping to address the affordability of home Internet service which is one of the causes of the digital divide.

Dig Once/Open Trench Policy

Street excavation to install underground infrastructure represents 70% to 80% of the cost of a fiber network buildout. A Dig Once / Open Trench policy could reduce the cost of network construction, while also ensuring efficient, non-duplicative street cuts. The concept is straightforward: once a street is opened or a trench is cut, a private entity already has invested the lion's share of what it would cost to install a fiber network. It makes economic sense to take advantage of that investment by expending the remaining 10% to 20% to place conduit underground for the County's use to install fiber for its institutional network. Lit recommends the following guidelines for a Dig Once / Open Trench policy:

- Require entities that apply for an excavation permit to notify other utilities and relevant entities and allow them to participate.
- Require the excavating entity to concurrently install extra conduit for its future use to minimize future street excavation.
- Require the excavating entity to coordinate with the County to install extra fiber and/or conduit for County-government's exclusive use. Lit recommends a minimum of one 2" conduit. This will enable the County to install up to 864 strands of fiber, which is the maximum strand count for a robust fiber network.

For reference, listed below are links to existing municipal dig once policies. The Gonzales, CA Dig Once Policy is straightforward and lists the types of projects that would require the

installation of a spare conduit for the City of Gonzales, CA and also specifies the standards for the conduit type and installation.

Salinas, CA
Gonzales, CA
Santa Cruz, CA
Breckenridge, CO

Dig Once / Open Trench programs can be implemented either as laws or policies. Lit recommends establishing Dig Once / Open Trench via municipal ordinance so that it is a law that continues from one administration to the next in contrast with a policy, which can change between administrations.

Furthermore, the language should avoid restrictive technical details and be broad enough to adapt to rapid advances in technology to ensure that the ordinance does not require frequent amendments. This same principle applies to the “One Touch Make-Ready” concept covered in a later section.

While Dig Once / Open Trench policies help a municipality to manage the placement of infrastructure in its rights-of-way and to reduce the number of pavement cuts and physical and monetary costs associated with those cuts, the requirement to coordinate the installation of infrastructure among multiple utilities often increases the time needed to complete a project. This increased time results in extra costs for all of the coordinating utilities. Therefore, it is not uncommon for utilities to protest Dig Once / Open Trench policies.

If the County were to implement a Dig Once / Open Trench policy, it could incent compliance by reducing fees for the participating utilities as a way to alleviate the costs associated with the extended time frames imposed by the policy.

Streamline Franchise / Permitting Processes

The ease of the permitting process can impact fiber deployment. People attempting to deploy a fiber network prefer to provide all required data and information as part of the initial submission to the municipality. Uncommunicative municipal staff, confusing or lengthy franchise/ permitting processes, and complicated fee structures make it difficult for fiber deployers to understand and comply with a municipality’s requirements. Therefore, it is imperative that municipal staff be willing to communicate and answer questions. This will help firms to submit appropriate information to comply with franchise and permit processes and reduce wasted time for both the municipality and the firm.

Likewise, short, easily understandable processes are attractive to private firms as are easy to understand fee structures that allow firms to calculate how much money they will owe and to understand exactly when they owe it and how to pay it. Additionally, staff at these firms dislike having to submit the same information to several departments. Even worse, staff dislikes having to submit different information to several departments.

Cities can eliminate this frustration by establishing one department as the designated point of contact and allowing firms to submit all information to that department. Then, staff in that department can share the information with their colleagues in other departments. These measures are crucial to reduce the amount of time and money firms must expend to successfully navigate a franchise / permitting process and may encourage firms to install fiber and offer high-speed service to residents and businesses in a municipality.

If streamlined processes attracted interest from multiple firms, a municipality might be able to leverage that interest to gain private sector assistance to install fiber for an institutional network for exclusive use by municipal government. Santa Cruz, CA implemented several policies to streamline, expedite, and reduce the cost of fiber broadband infrastructure build outs. Among the policies, the County developed master lease agreements to allow the placement of fiber infrastructure on county assets.

Wireless Policy

There have been notable improvements in wireless technologies. Wireless carriers, such as AT&T and Verizon, have announced plans to expand their wireless infrastructure to deploy 5G technologies. 5G networks operate on the millimeter wave spectrum, a high frequency band of wireless spectrum, capable of delivering speeds ten times faster than 4G LTE. However, the millimeter waves do not travel as far as the lower-frequency waves used in today's wireless networks. As a result, carriers will have to install more wireless infrastructure, such as towers and antennas, therefore requiring more fiber.

Lit recommends implementing a wireless policy to regulate the installation of wireless infrastructure. The policy would protect the County's assets and interests by minimizing the potential adverse visual effects of more towers and antennas. Similar to the streamlined franchise and permitting processes, a clear wireless policy can help attract carriers and facilitate the growth of wireless infrastructure. The increase in wireless infrastructure will stimulate fiber infrastructure growth because the wireless access points are fed with fiber cable. If the County chooses to place spare conduit when constructing a middle mile or fiber to the home/business network, the County would be able to gain revenue by leasing the spare conduit to existing ISPs looking to expand their wireless infrastructure. For reference, listed below are links to existing wireless policies:

Example ROW Ordinance
Breckenridge, CO
Troy, AL

One Touch Make-Ready

Per the National Electrical Safety Code (NESC), attachments on a utility pole must be spaced a certain distance apart. This helps to preserve the structural integrity of the utility pole and protect public safety. Before a new attachment, including fiber optic cable, can be added to a utility pole, the existing attachments must be moved to make space for the new attachment. The process of assessing the pole and attachment conditions and moving the existing attachments to create space for new attachments is called make-ready work. It is one of the biggest hurdles in aerial construction because it can create massive delays as the utility that wants to add an attachment must wait for each utility with existing attachments to respond to the make-ready request.

The County can create a One Touch Make-Ready (OTMR) policy, implemented by ordinance, to expedite the process. Under OTMR policies, pole owners and utilities must agree upon a qualified engineering and construction firm to conduct all the necessary surveys and attachment moves. A single firm would perform all the work, which would greatly reduce the time associated with make-ready work. For reference, listed below are links to existing OTMR policies:

San Antonio, TX
Louisville, KY
Nashville, TN

The County can easily implement a OTMR policy for County owned poles. However, the County will have to work through several layers of regulatory authorities to implement OTMR policies on poles owned by private utilities. Nationally, One-Touch Make Ready has two parallel tracks: “opt-in” states and “opt-out” states.

In “opt-in” states such as Pennsylvania, federal regulations apply, meaning that localities and states do not have to adopt the federal policies. Rather, federal policies directly apply to these states and entities within these states. No action is necessary by local and state governments, except to comply with the federal regulation.

“Opt-out” states are those that are certified to the Federal Communications Commission that they regulate pole attachments. “Opt-out” states have freedom to create policies as they see

fit. Their policies do not have to be more stringent or more relaxed in relation to federal rules. “Opt-out” states thus regulate pole attachments at the state and local level.

Create Standards for Conduit Placement

Lit recommends developing standards for conduit placement to ensure provisions are in place for fiber optic facilities in new business and residential developments. Requirements can be imposed on new land development to install fiber optic infrastructure. Standardized duct banks, designed per road classification (arterial, primary, residential, etc.) should be created to expedite the design and construction processes. Specific conduit requirements for new buildings should be integrated in the building permit application process. Having these policies in place will ensure a path for future fiber optic cables and will mitigate future construction and fiber installation costs.

- Duct size
- Quantity of ducts
- Vaults – size & distance from each other

The standards can be added to existing engineering documentation or policies for construction. The County can review more information on this process and where other communities have done this in different methodologies at Muni Networks and the “smart conduit” concept.

Create Standards to Address Fiber & Conduit Breaks

Standards should be set to prevent damage to the network infrastructure. For example, fiber cable should not be buried in the earth without a protective cover. Rather, it should be encased in conduit. Also, setting a minimum depth for the conduit and fiber to be installed, typically 36” below grade, will help prevent a cut when excavation work is performed near the conduit.

When the County solicits general contractors to build and then maintain and operate the network, the service level agreements (SLAs) should include terms for the general contractor to repair conduit and fiber breaks and then invoice the party that caused the damage.

Keep GIS Database Updated with Existing and New Infrastructure

County staff should maintain a GIS database of all County owned and all privately owned broadband assets in York County. Private firms should be required to submit documentation of changes to their facilities in County rights-of-way to verify broadband infrastructure in York County and reduce duplication.

Lit recommends having one full-time equivalent dedicated solely to documenting public and private-sector broadband assets for the County's GIS database.

"Synchronizing" Other Ordinances

In addition to considering dig once/open trench and OTMR ordinances, the County should evaluate other ordinances and regulations whose provisions may impact (or could be leveraged to facilitate) high-speed broadband deployment. This evaluation should be directed at "synchronizing" different ordinances so that they work in unison to support the County's broadband policies. Beyond the specific ordinances and regulations, the County should analyze the Code of Ordinances generally for scattered provisions that could impact broadband. The initial task of identifying potential revisions to the Ordinance would be a legal review. Afterward, the remaining effort would be a collaborative revision between the County's attorney and the entity/agency that ultimately would own the broadband network. The County should seek input from its fiber broadband consultants, telecommunications infrastructure builders, and end users.

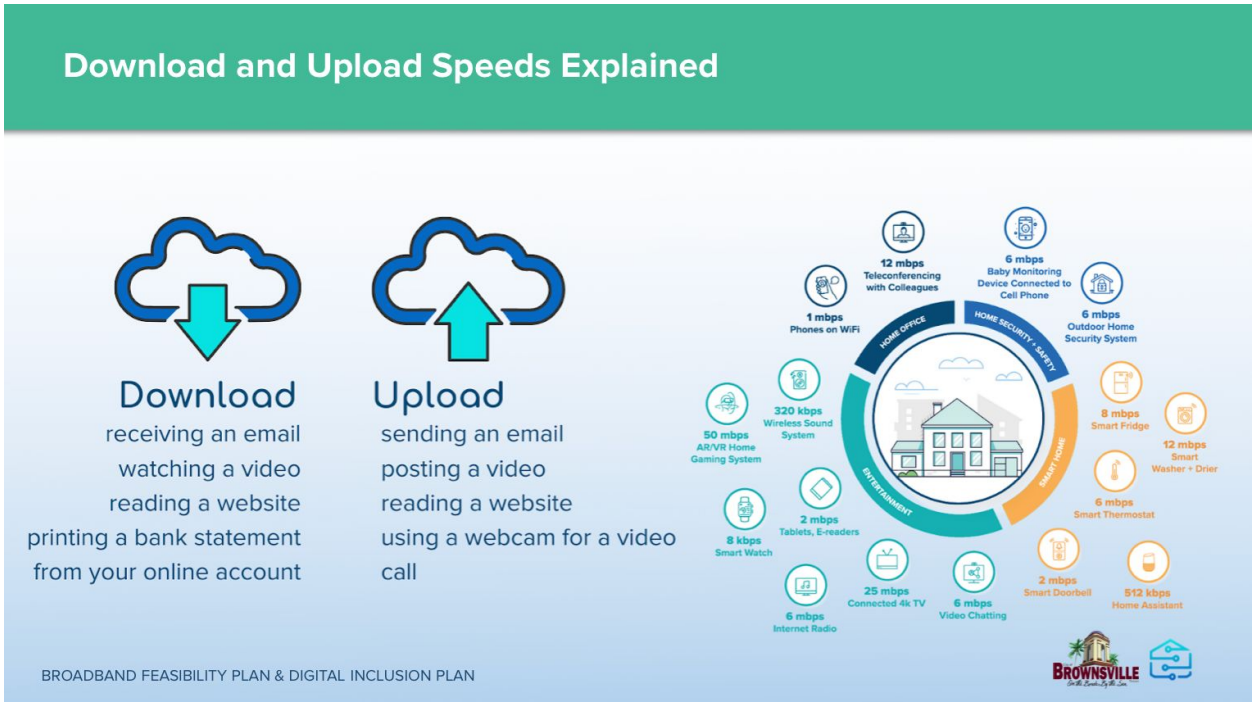
Tips When Looking for a Data Center in Your Community

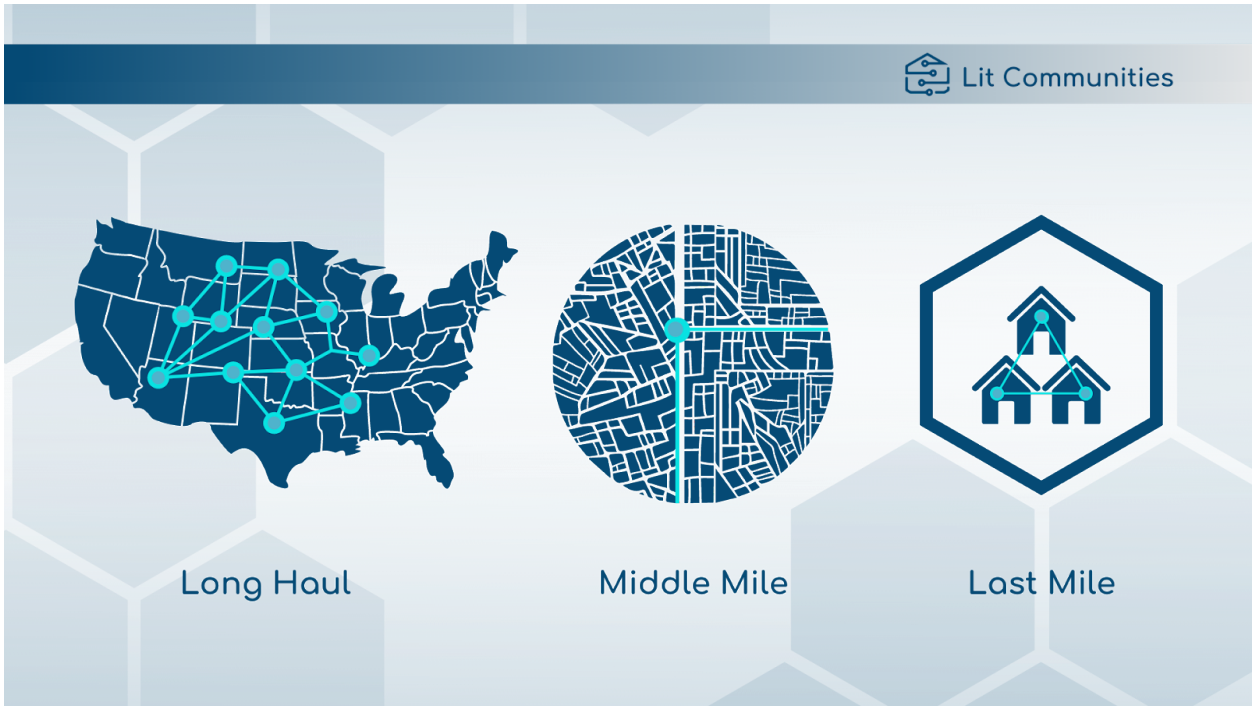
1. Choose a location that is not prone to flooding or fire
2. Can the building obtain high speed network links? Ideally the network connections should enter the building at diverse locations
3. Are pathways such as doorways, hallways large enough for equipment racks and cabinets to be moved inside and out?
4. Power planning for today and the future is one of the most critical items in a Hub site. Consider redundancies - Can the utility company provide the needed power and redundancy; Can the building be served by multiple electrical grids; Can power be supplied directly or will conversion be required (you want to avoid spikes & surges); Is there enough back up power from generators (you will want this generator to be able to support for at least 48 hours during an outage); Equipment racks will require 5-10kw and high density racks up to 40-60kw
5. Once we determine who you are going to interconnect to - how much rack space do/does your ISP(s) require; Is there room for rack space growth
6. Heating, venting and air conditioning is essential to a successful hub site. 50% of all power used is taken up by the HVAC; you will want to keep the ambient temp 65-70 degrees F and 30-50% humidity; you need a method to monitor the temperature - temperature sensors on the racks are the best way to help do that. Use a

hot-aisle/cold-aisle design to simplify temp control; slab floors can work well but often require in aisle cooling

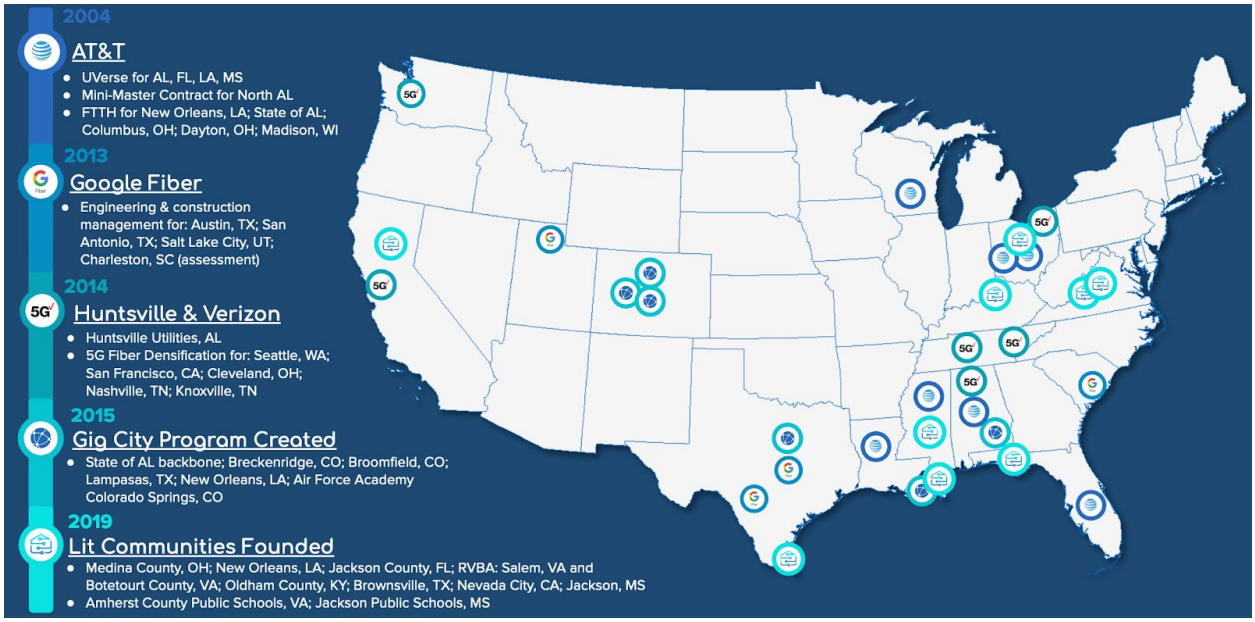
7. Lighting is important for techs working in the hub; LED lighting uses the least amount of power and does not generate heat
8. How will the HUB be secured? Consider access cards/key cards; Are there enough fire alarms and escapes? (local codes should rule)
9. What fire suppression will be used? You need to keep expensive equipment from getting wet, special inert gas fire suppression can be used instead of water

Internet Speeds Explained





Lit Communities Business Case Studies



LIT'S COMMUNITY AND SCHOOL CONNECTIVITY ASSESSMENT & DIGITAL INCLUSION CLIENTS

Medina County, OH
Community Assessment

New Orleans, LA
Community Assessment

Jackson County, FL
Community Assessment

Salem, VA
Community Assessment

Amherst County, VA
Community Assessment
School District Connectivity Assessment

Brownsville, TX
Community Assessment &
Digital Inclusion

Oldham County, KY
Community Assessment

Nevada City, CA (Spiral)
Community Assessment

Botetourt, VA
Community Assessment

Jackson, MS
Community Assessment
School District Connectivity Assessment

Brownsville, TX - Broadband Feasibility & Digital Inclusion Plan	Scope
Project: Brownsville, TX **Date:** July 2020 - present **Size:** 38,000 demand points **Budgeted Cost:** $155,000 (assessment only) **Estimated Network Cost:** $67MM **Anticipated Completion:** January 2021 **Scope:** Broadband Feasibility & Digital Inclusion Plan **Network Type:** Aerial/Underground & Wireless **Technologies used:** Demand aggregation, GIS, Automated design, Smart City Applications **Firm Involvement:** Lit is working with Brownsville on a City-wide broadband feasibility study and digital inclusion plan. It is no secret that Brownsville is the least connected city in the US and Lit is partnering with Brownsville to change this reality. Lit is working with the City of Brownsville to 1) identify and assess its connectivity and digital inclusion issues, 2) develop a broadband strategy, 3) design a broadband network, 4) deploy a broadband network, and 5) apply for relevant federal and state grants. As part of this work, Lit has partnered with the City to launch a connectivity survey in both English and Spanish to reach as many residents and businesses as possible to understand the digital divide in the City as well as potential appetite for fiber to their homes and businesses. **References:** Ramiro Gonzalez, City of Brownsville, TX, Director of Government and Community Affairs, ramiro.gonzalez@cob.us, 956-548-6007 **Press:** ● "Getting Connected: City Hires Broadband Consultant" ● Podcast: Survey underway to measure Brownsville's digital divide ● Lozoya: Take the Broadband for Brownsville Survey!	 ✔ **FTTP Broadband Feasibility & Community Assessment** ● Demand Aggregation (in English and Spanish) ● Analysis of Incumbent Service Providers ● Fiber / Asset Inventory ● Preliminary Design and Engineering ● Creation of Financial Model and Business Plan ● Assistance with Selection of Vendors/Providers for Network ● Wireless deployment as needed ✔ **Digital Inclusion** ● Identify and recommend options for how to close digital divide in the City ● Develop a digital inclusion plan for the City to assist low-income families and for digital literacy ● Assist City in creating workforce development programs tied to broadband and digital inclusion

Amherst County, VA - County Wide Broadband Assessment	Scope
Project: Amherst County, VA **Date:** August 2020 - Present **Size:** 16,000 demand points **Budgeted Cost:** $116,513 (assessment only)  **Anticipated Completion:** December 31, 2020 **Scope:** Public Schools Mesh WiFi Network Assessment & County-Wide Broadband Assessment **Network Type:** Wireless & Aerial/Underground **Technologies used:** Wireless, Demand aggregation, Automated design, Smart City Applications **Firm Involvement:** Amherst County, VA is utilizing COVID-19 CARES Act funding to achieve its goal of connecting every student and resident in the County with internet/fiber. Lit is conducting two related assessments to connect students with wireless access for remote learning and a County-wide assessment to plan a fiber network. Lit is also assisting the County and public schools with federal and state grant applications related to their connectivity goal. **References:** 1) Dr. Robert Arnold, Amherst Public Schools, rarnold@amherst.k12.va.us, (434) 941-5211 2) Dean Rodgers, Amherst County Public Administrator, dcrodgers@countyofamherst.com, 434-946-9400 **Press:** ● 'The clock is ticking': Authority works to secure broadband expansion projects with CARES money	✔️ **FTTP Community Assessment** ● Demand Aggregation ● Preliminary Design and Engineering ● Creation of Financial Model and Business Plan ● Assistance with Selection of Vendors/Providers for Wireless/Fiber Networks ✔️ **Public School Wireless Network Assessment** ● Preliminary Design and Engineering ● Creation of Financial Model and Business Plan ✔️ **FTTP Design** ● Drawings & Shapefiles ● Route Optimization ● Public Poles Utilization ● Field and Site Surveys ● Aerial & Underground ● Coordination with County officials ● Permitting ● Right of Way Analysis ● Industry Best Practices Application ● Provide GPS references

Medina Fiber (Medina County, Ohio)	Scope
Project: Medina County, OH  **Date:** July 2017 - Present **Size:** 423 mi^2, 92 miles of fiber **Budgeted Cost:** $55 MM **Anticipated Deadline:** 12 months for construction of Phase 1 and 3 years for Phase 2 **Scope:** Build out of FTTH/B for approximately 44,000 residents and businesses **Network Type:** Open Access; Aerial & Underground Build **Technologies used:** Automated design, LiDAR collection & extraction, Smart City Applications **Initial Services:** Internet: 100/100 Mbps, 250/250 Mbps, 1 Gig; Telehealth **Middle Mile:** Medina County Fiber Network ("MCFN") is an Open Access middle mile ring connecting all major cities within the County serving large and medium businesses. MCFN, launched in 2011, has 13 carriers offering services across the County's infrastructure. In 2017, Dave Corrado, CEO of MCFN, met Brian Snider, CEO of Lit, and devised a plan to bring fiber to homes and businesses. **Firm Involvement:** Lit Communities and its capital provider are joint owners of this project. Lit is bringing the most efficient team together to light this network, working with partners from the engineering side to the operations and maintenance. Lit is partnering with MCFN, leasing strands to build last mile connectivity to the residents and small businesses of the County. Lit formed the capital structure for this project with no request to the County to pay for any of it. **Phase 1:** Funding secured of approximately $8 million without any capital expenditures by cities/towns or the County. ~ 6,500 residents and businesses **Reference:** David Corrado - CEO; Medina County Fiber Network, 144 N. Broadway, Medina, OH 44256; Phone: (216) 832- 7059; E-mail: dcorrado@fibercounty.com **Press:** • Medina County Fiber Network and Lit Communities Reach for Ohio Residents • Newly formed Medina Fiber LLC gets residential project off the ground	✔ **FTTP Community Assessment** • Demand Aggregation • Preliminary Design and Engineering • Creation of Financial Model and Business Plan ✔ **FTTP Design** • Drawings & Shapefiles • Route Optimization • Public Poles Utilization • Field and Site Surveys • Aerial & Underground • Coordination with County officials • Permitting • Right of Way Analysis • Industry Best Practices Application • Provide GPS references ✔ **FTTP Construction** • Identify installation method and develop plan to Install equipment • Work with Contractor on personnel, equipment, safety standards • Oversee Contractor to meet deadlines ✔ **Project Management** ✔ **Fiber Splicing, Testing** ✔ **Documentation, Labeling** ✔ **OSP Infrastructure** • Secure ISPs/XSPs who offer broadband, competitive pricing, next gen services, customer support ✔ **Site Restoration** ✔ **Secure O&M Partner**

NOLA Net / FiberBlaze (New Orleans, Louisiana)	Scope
Project: NOLA Net **Date:** March 2017 - Present **Size:** Phase 1: 432 miles (77% underground, 23% aerial) **Budgeted Cost:** Approximately $61.4MM for Phase 1  **Anticipated Schedule:** Construction scheduled for 2020 - 2024 **Scope:** Build out a fiber-to-the-premise network to residents and businesses to approximately 61,000 residents and businesses (Phase 1) **Network Type:** Open Access; Aerial & Underground Build **Technologies Used:** Demand aggregation, Automated design, LiDAR collection & extraction, Smart City Applications **Initial Services:** Residential Internet: 50/50 Mbps, 100/100 Mbps, 500/500 Mbps, 1 Gig; Business Internet Packages; VoIP; Telehealth; Smart Home / Smart City Applications **Middle Mile:** Uniti Fiber is a unified force in network services with a combined focus on dense urban and metro areas, as well as lower-tier and rural markets, Uniti Fiber is committed to developing network solutions across the country. Uniti will be the middle mile (or access to the internet) partner in the NOLA Net project. **Firm Involvement:** Lit Communities and Jackson Solution Services ("JSS") have partnered together to create NOLA Net, to bring Open Application Networks to New Orleans, LA ("City") and beyond. Lit and JSS have worked together to complete a broadband plan for the City, which has committed to moving forward with two backbone fiber network rings, one for public safety and one for economic development. In parallel, JSS and Lit worked with Delgado Community College to create a Fiber Academy class, where this past semester students in the class completed a Broadband Community Assessment in multiple neighborhoods within the boundary of the City's public safety backbone network. The New Orleans Phase 1 financial model is the result of the Community Assessment to date. Lit and JSS are currently seeking investors to contribute to bringing better connectivity to unserved and underserved residents and business owners in the City (and beyond) through Fiber-to-the-Home ("FTTH") technology. **Reference:** City of New Orleans, LA, Kim LaGrue, Chief Information Officer, Phone: (504) 658-7600, Email: kwlagrue@nola.gov	✔ **FTTP Community Assessment** • Demand Aggregation • Preliminary Design and Engineering • Creation of Financial Model and Business Plan ✔ **Fiber Academy** • Workforce Development ✔ **FTTP Design** • Drawings & Shapefiles • Route Optimization • Public Poles Utilization • Field and Site Surveys • Aerial & Underground • Coordination with County officials • Permitting • Right of Way Analysis • Industry Best Practices Application • Provide GPS references

RVBA - Salem (Salem, Virginia)	Scope
Project: Roanoke Valley Broadband Authority (RVBA) in Salem, VA **Date:** September 2019 - Present **Size:** 14.63 mi^2, 135 miles of fiber **Budgeted Cost:** $14MM **Anticipated Deadline: TBD**  **Scope:** Community Assessment in Salem, VA for a FTTP Network, working with RVBA to secure funding and develop business plan and financial model to build out FTTP for approximately 29,696 residents and businesses **Network Type:** Open Access; Aerial & Underground Build **Technologies used:** Demand Aggregation, Automated design, LiDAR collection & extraction **Initial Services:** Internet: 100/100 Mbps, 500/500Mbps, 1 Gig; Telehealth **Middle Mile:** RVBA is an Open Access middle mile ring connecting all major cities within Roanoke County serving large and medium businesses. RVBA, launched in 2011, has 13 carriers offering services across the County's infrastructure. **Firm Involvement:** Lit is completing a Community Assessment and will work with RVBA to design, engineer and secure funding for a FTTP network for the Roanoke Valley starting with the City of Salem. **Reference:** Frank Smith- President and CEO; Roanoke Valley Broadband Authority, 601 S Jefferson St, Roanoke, VA 24011; Phone: (540) 904-4739; E-mail: fsmith@highspeedroanoke.net **Press:** • RVBA to bring fiber-optic connections directly to homes	✔ **FTTP Community Assessment** • Demand Aggregation • Preliminary Design and Engineering • Creation of Financial Model and Business Plan ✔ **FTTP Design** • Drawings & Shapefiles • Route Optimization • Public Poles Utilization • Field and Site Surveys • Aerial & Underground • Coordination with County officials • Permitting • Right of Way Analysis • Industry Best Practices Application • Provide GPS references

a. Economic benefits of broadband- Medina County Fiber Network

Economic Development Statistics

Constructed by the Medina County Port Authority in 2011, the publicly-owned Medina County Fiber Network (MCFN) benefits our commercial and industrial sectors. It is directly responsible for attracting business to Medina County.

We have seen $343,689,375 in capital investment by MCFN customers from 2014-2018:

- They have created 1,003 new jobs with a payroll of over $34 million.
- They have retained 5,112 jobs.
- They have created or absorbed 2.2 million square feet of space.

What do these numbers mean?

If we divide projects created by Medina County Fiber Network customers by the county as a whole, it adds up to:

Nearly half of total payroll created, half of capital investment, half of square footage, and new jobs, and nearly three-quarters of jobs retained.

- 40% of total payroll created
- 48% of capital investment
- 49% of square footage
- 42% of new jobs
- 71% of jobs retained

https://www.medinacountyfibernetwork.com/economic-development-statistics/

Disclaimer

In July 2010, Congress passed the Dodd-Frank Act, which included a provision (Section 975 "Regulation MA", which amended Section 15B of the Securities Exchange Act of 1934) to protect municipalities, taxpayers, and investors from conflicted advice and unregulated advisors. In particular, the Dodd-Frank Act requires the SEC to adopt a rule requiring these municipal advisors ("MA") to register with the SEC and comply with a set of regulations that would be issued by the Municipal Securities Rulemaking Board (MSRB). In accordance with Securities Exchange Act Section 15B(e)(4)(C), the Final Rules set forth several exclusions for professionals offering advice, including engineers providing engineering advice.

Neither Lit Communities ("Lit"), a broadband design, engineering, and construction firm, nor any of its subsidiaries, are registered as a Municipal Advisor. Lit relies on the engineering exemption of the Securities Exchange Act Section 15B(e)(4)(C), and this material is also being provided to you for general information only. Lit may provide advice on the engineering aspects of your broadband project that may be financed, in whole or in part, by an issuance of municipal securities; provided that such advice does not include advice with respect to structure, timing, terms, or other similar matters concerning such issuance of municipal securities.

Lit is not recommending any action to you as the municipal entity or obligated person. Lit is not a municipal advisor, financial advisor or agent and therefore does not owe a fiduciary duty pursuant to Section 15B of the Securities Exchange Act of 1934 ("Section 15B") or otherwise.

Accordingly, the information in this proposal is not and should not be construed as “advice” as defined in Section 15B or as financial or tax advice. You should discuss all information and material contained herein with all internal or external advisors or experts that you deem appropriate, including but not limited to tax, legal, accounting and financial advisors, before acting on this information or material. The data herein is subject to availability and past performance on specific transactions discussed does not indicate future performance.